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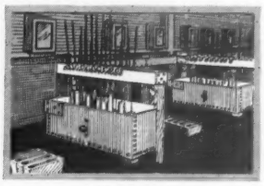
But the process of incorporation did not change the fact that they were just a group of earnest young men fired with an idea.



After many heartaches they produced and sold a few pounds of the new metal. For months business came slowly, almost pound by pound. But there came a time when the days weren't long enough for these few men to do all the work. So they engaged others to help. Men to find ways to make Aluminum stronger and harder, men to improve production methods, men to devise new ways to use Aluminum, more men as salesmen to demonstrate the new uses.

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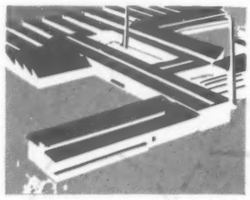

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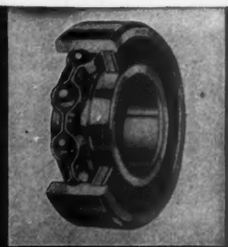
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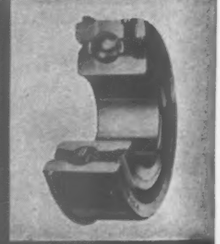
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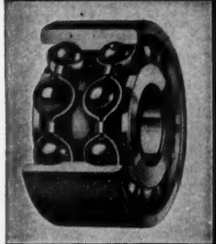
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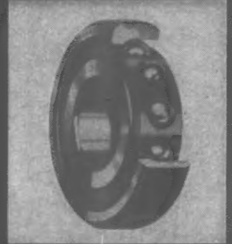
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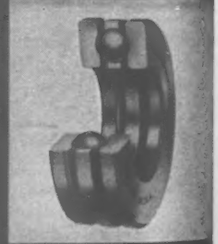
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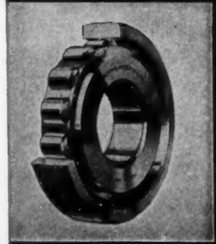
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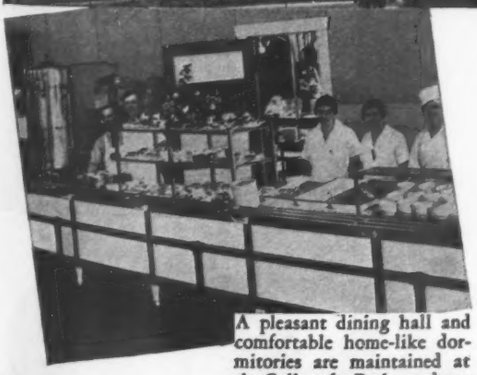

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SHOOTING

"Me hear — no see," grunts this old Indian Chief. Capt. Ray Wilson's aerial photos are taken 21,000 to 24,000 ft. above sea-level.

Photo courtesy of Ray Wilson, Inc.

Capt. Ray Wilson's photographic plane with Pilot Mark Schellenberg. Ground temperatures hit 98°. Temperatures aloft get down to 15 below zero. New Texaco Airplane Oil keeps the Wright Engine okay, hot or cold. It is a prime factor in those long, hard, open-throttle climbs to 24,000 ft. altitude.

Photo courtesy of Ray Wilson, Inc.

Above — *Norman Schmid, Forest Service Photographer, and Photographic Pilot Mark Schellenberg, in front of the Cessna DC 6A, 4 PCLM, powered by a 330 h.p. Wright Engine. With Capt. Ray Wilson's Fairchild camera, standard commercial size oxygen tank, pilot and photographer with their parachutes, the plane weighs 3,475 lbs., or ¾ of its capacity.*

Right—*Looking straight down on Denver's Civic Centre, from 10,000 ft.*

Photo courtesy of Ray Wilson, Inc.

NEW TEXACO

THE ROCKIES... from 24,000 feet

LANDING FIELDS FEW AND FAR APART

SWEEPING BACK AND FORTH in straight, parallel lines over the 14,000 ft. peaks of the Rocky Mountains—photographing the terrain for the Government's Forest Service—is Pilot Schellenberg's job. Mr. Schellenberg flies for Capt. Ray Wilson, Manager of the Park Hill Airport at Denver, Colo.

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> *"The condition of the motor remains excellent with the usual period between overhauls, although it is run at wide-open throttle for a considerable period of the flight while climbing. Our gasoline consumption at high altitudes runs as low as eleven to twelve gallons per hour for this engine. The oil consumption will average about one quart an hour."*

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Photo courtesy of Ray Wilson, Inc.

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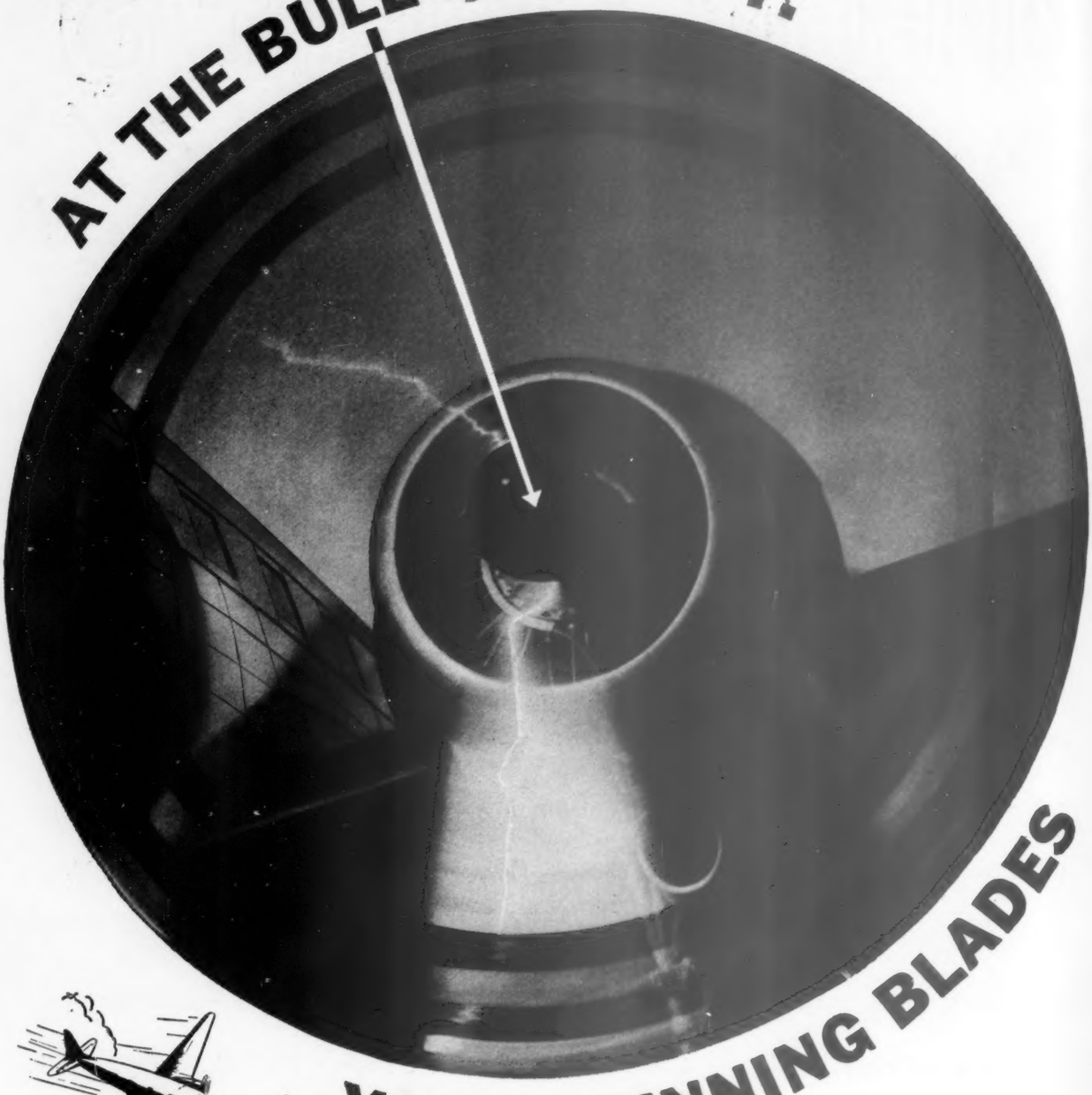

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de Havilland Albatross

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(February 1937 — January 1938)

Months	Number Graduated	Number Placements	No. Co.'s Employing Graduates
1937			
Feb.	4	13	7
Mar.	33	21	11
Apr.	8	16	6
May	1	16	6
June	34	14	8
July	5	7	2
Aug.	4	2	2
Sept.	20	17	7
Oct.	4	3	2
Nov.	2	2	2
Dec.	29	7	5
1938			
Jan.	7	14	6
TOTAL	151	132	27

Students in "Airline Operations" course taking down school-owned Wasp Motor—one of 15 different types which are studied.

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Flashes

From the Skyways of the World

» IF ANY OF YOU tried to get in touch with the editors of AVIATION at their home offices during the first week in February you probably were disappointed, for the entire staff had migrated to Chicago for Show Week. At one time or another every editor and every salesman was present. To and from Chicago, AVIATION'S expeditionary forces used up some 12,000 miles of airline travel plus another 1,000 miles of rail travel (when the weather went bad).

» FOR THE FIRST TIME IN HISTORY representatives of most of the aviation magazines sat down, put their feet under the same table, and discussed some of their common problems. Time: Feb. 1, 1938. Place: Chicago's Medinah Club. Present: *Aero Digest, Air Trails, American Aviation, Aviation, N. A. A. Magazine, Pilot, Sportsman Pilot, Popular Aviation, Southern Flight and Western Flying.*

» ANOTHER HIGH SPOT of the Show Week's program was the "Bar Nothing" banquet given by President C. R. Smith of American Air Lines for the visiting industry. Over 300, in starched bosoms and black ties sat down to partake of the hospitality of the famous Saddle and Sirloin Club, to be amused by song and skit, and to listen to the Assistant Secretary of War explain what a fine air force we have.

» ABOUT A YEAR AGO we pointed out that Miss Mildred Johnson had set up an air shopping service at 480 Lexington Ave., New York. We saw her out at the Chicago Show where she had a booth set up and seemed to be doing right well. You may have a bulletin explaining just how her service works by dropping her a line at the above address.

» THAT SCIENTISTS are not without a sense of humor was demonstrated at the annual smoker of the Institute of the Aeronautical Sciences, a feature of the annual meetings at Columbia University (see AVIATION News). Not only did Charlie Lawrance relate the experiences of a certain Monsieur Picon in the traditional manner, but the assemblage was privileged to witness the world's premier demonstration of the Compound Regenerative Air Regulation Disintegrator and Recorder by its inventor, Louis DeFlorez. This ingenious device takes up the interpretation of the CAR where Messrs. Fagg, Mulligan, Knott, *et al* leave off. Readers may recall the success of the Hunsaker-DeFlorez Multibellied Beta of the year before.

Other high spot of the evening's entertainment was the presentation of the award shown herewith to Lester Gardner, as the world's champion aerial hitch-hiker. According to the citation Major Gardner has thumbed his way over more of the world's airlines than anyone else.

Presented to Lester Gardner, world champion aerial hitch-hiker.

» QUITE A FEW PEOPLE seem to be taking advantage of the opportunity offered by the airlines to take their wives along free this month. Many of the gals are getting their first

In This Issue—

The payoff on the late Chicago air show in the form of a brief resume of exhibit trends and some pictures of planes and people attending . . . . How one successful fixed base operator makes money out of a waterfront location with ships on floats. . . . A picture trip through United Air Lines' maintenance base and overhaul shops at Cheyenne showing some of the latest equipment. . . . The second of two articles by Elias Moness of the Douglas Stress department on the graphical solution of certain complicated structural problems. Mr. Moness' first article appeared in AVIATION for December, 1937. . . . Some glimpses of the Giant DC-4 as it approaches completion in the Douglas factory at Santa Monica. . . . A group of new flying equipment items including the Noordyn Norsman, the Federal Trainer, latest Stinson, and a group of engines including the Menasco and the Lycoming 50 hp., the Franklin 50 and a new Fairchild Ranger.

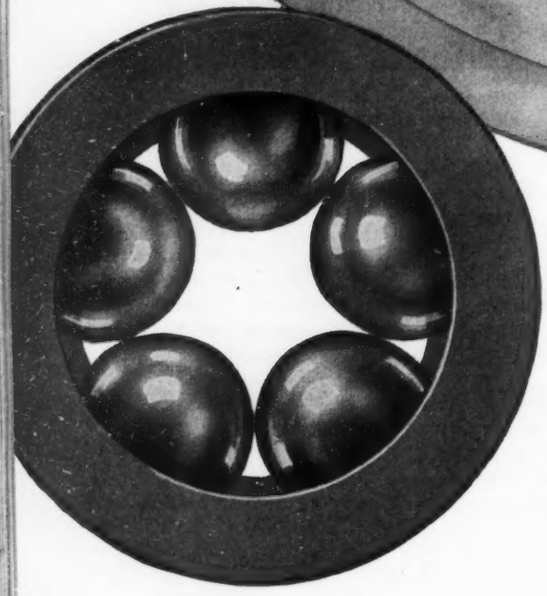
BALLS ARE MICRO-INSPECTED . . .
Arriving specially packed, the precision-made balls for Sperry bearings are scrutinized through high-powered lenses by trained inspectors, who search for flaws and check for surface contour. Tapers and raceways are included in this inspection.

TESTED BY PRECISION MACHINE . . .
Hardness testing is a Sperry feature, both for balls and for tapers and raceways. These polished surfaces must withstand continuous high-speed contact . . . Afterwards, the size and curvature are measured by accurate electro-mechanical gauges.

ARE *MATCHED* AND ASSEMBLED . . .
Out of these fine and uniform bearing balls, *matched sets* are selected by a Sperry machine that checks diameters to 1/100,000 of an inch. Each ball-set, assembled with outer raceway and inner taper, becomes a bearing for a Sperry instrument.

THEN "STETHOSCOPED" IN MOT
Working in soundproofed, air-c
ditioned rooms, Sperry experts g
rotor-bearings a thorough ear-t
With the rotor singing a melod
10,000 revolutions a minute and
any irregularity in note is ca
and the bearing at once is reje

*R*e-measured to 1/100,000 of an inch and matched in sets like pearls . . . the balls for SPERRY GYRO BEARINGS



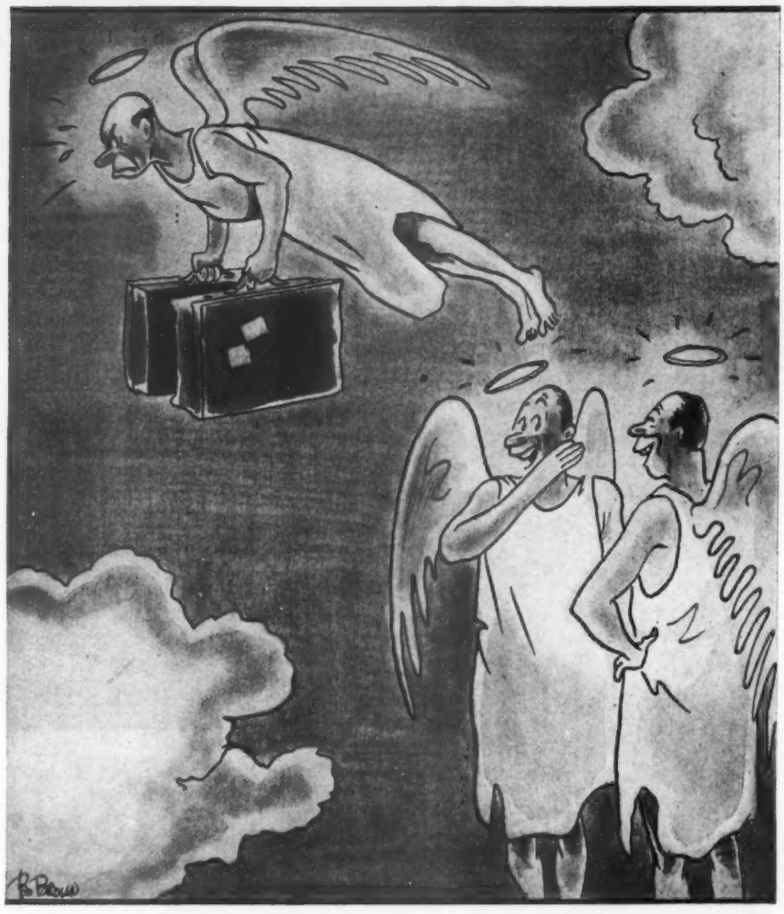
Typical of Sperry precision methods are those described above for obtaining in every instance the finest bearings for rotor units. The pilot's ability to guide his plane unerringly from point to point depends largely on the true and dependable functioning of the Gyro-pilot and other Gyro Instruments. Conscious of this responsibility, Sperry has developed over the years the highest standards of accurate workmanship and thorough inspection. Sperry's *exact* manufacturing methods in many cases are wholly its own and constitute industrial pioneering of the highest order. *Sperry Gyroscope Co., Inc., Brooklyn, N. Y.*

SPERRY

EXACTNESS IN EVERY PROCESS OF MANUFACTUR

taste of transport aviation and are liking it. Although the idea originally was intended to reduce the sales resistance on the distaff side to menfolks' traveling, another interesting angle has turned up. It seems that a number of potential male customers have used the excuse that "the little woman won't let me fly" to cover up their own timidity. Now they are between two fires when the "little woman" begins high-pressuring them at home to take a trip by air so that she can go along!

» AND THE PROBLEM of whether or not the ravishing blonde accompanying the cash customer is his lawfully wedded wife has reared its ugly head. No airline that we know of has demanded the presentation of wedding certificates, but sometimes the problem solves itself. For example, there was the slightly inebriated gent who turned up with a lady in Kansas City one night, demanding dual transportation. Unfortunately, he didn't have quite enough cash to pay for one ticket so presented a small check for the balance. As a matter of reference he was asked to give his address, and from behind the scenes a telephone check was made to establish his identity. Unfortunately the customer's better-half was at home and our would-be week-ender promptly found himself in the doghouse.



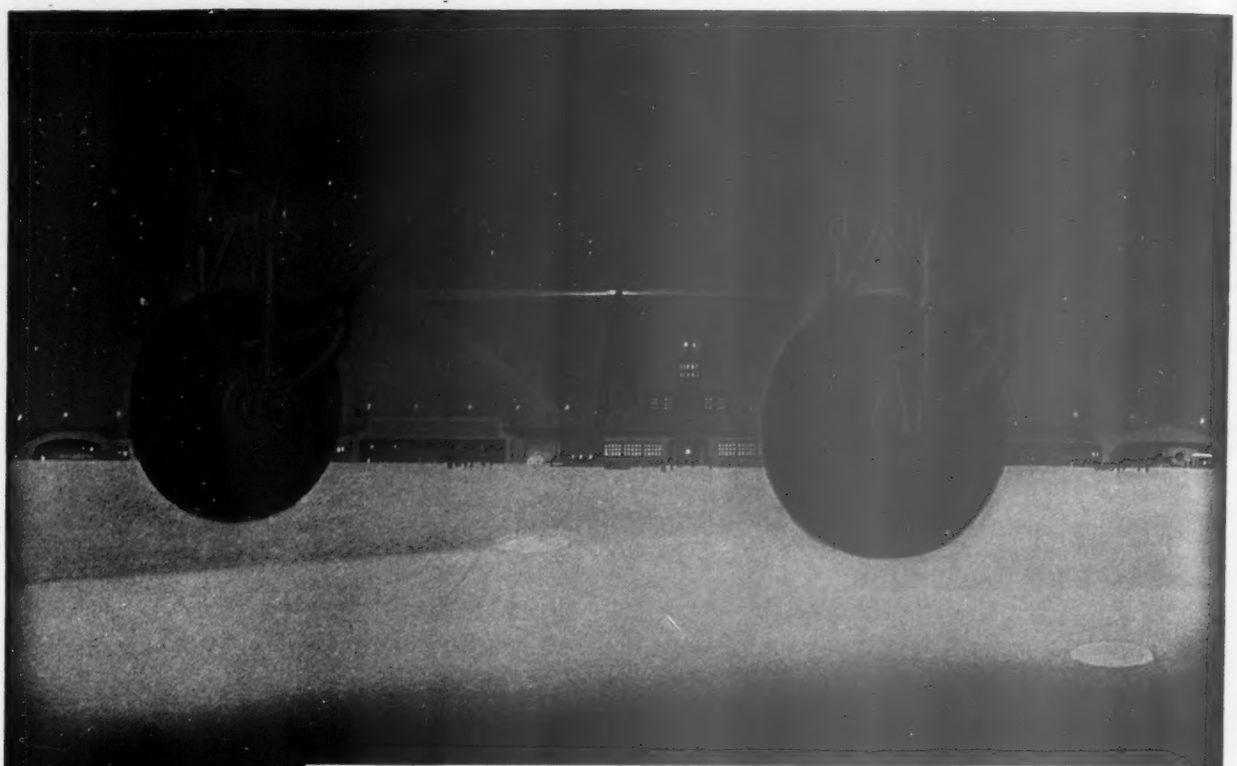
"Maguire complained that his wings were icing up so they told him to go to hell!"

» WHILE CRUISING up and down the airlines in the past several weeks, we ran across a couple of amusing incidents alleged to be strictly true, although not guaranteed. Seems that a caterer at a certain stop inadvertently packed a live mouse into one of the "snack boxes". The mouse not only helped himself freely to the contents of the box, but when the hostess opened it up to serve tea, popped out and had a fine time galloping up and down the aisle to the collective amusement and consternation of the passengers, until he finally stowed away in the forward cargo pit to the end of the flight.

» THEN THERE IS THE STORY of the nice old lady in Seat 6 on a southbound night flight, who stopped the pilot on one of his trips back through the cabin and, pointing out the window, asked what the little red light was. "That, Ma'am," he said, "is a navigation light." On his way back forward she stopped him again, pointed out the other side to the green light and inquired what that was. "That is also a navigation light," said he. Whereupon the light of understanding illuminated her features and she said, "How clever! All you have to do then is to fly between the navigation lights!"

» Recently most of the airlines have added several new little touches to provide mental stimulus and comfort for passengers. At least once on most flights the stewardess passes around a position report filled out by the pilot giving pertinent facts for the flight, such as position-at-the-moment, altitude, outside temperature, speed and probable time of arrival at destination. This idea has long been in use on several airlines in Europe and seems to interest most passengers that we have observed here.

Then, the other day, we came in over Newark when ceiling and visibility conditions made instrument approach necessary. As several trips were in ahead of us, we were held off, cruising back and forth on the Elizabeth Range until we were given our clearance to come down through. Not only did the stewardess explain to the passengers the reason for the delay, but small pamphlets were passed out in the ship explaining just how Airways Traffic Control works and why it is necessary to stack ships up and bring them in one at a time to avoid collision. Such little things seem to us to be worthwhile.



Service!

The most important factor in obtaining lasting Satisfaction is SERVICE.

If efficient SERVICE is not available, then Satisfaction is short-lived in spite of all the Consultations, perfect Correlation and splendid Cooperation which may have contributed to the attainment of that Satisfaction.

But Bendix assures continuous Satisfaction, for Bendix may always be depended upon to provide that most important factor—that natural "follow-up" of Satisfaction—that fulfillment of an obligation—efficient SERVICE.

Consult with Bendix before that next undercarriage is laid out.

BENDIX PRODUCTS CORPORATION

AIRPLANE WHEEL AND BRAKE DIVISION

(Subsidiary of Bendix Aviation Corporation) South Bend, Indiana

BENDIX

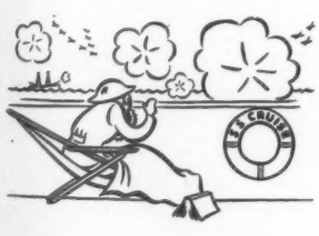
AIRPLANE WHEELS · BRAKES · PILOT SEATS · PNEUDRAULIC SHOCK STRUTS

Side Slips

By
ROBERT
OSBORN

» THE MARITIME COMMISSION is reported to be considering the construction of three luxurious passenger-cargo vessels which would be readily convertible into aircraft carriers in time of war. The boats would have long hulls, wide beams, and speeds of 25 knots. Wide decks and large holds would provide spaces for airplane hangars, and the auxiliary smokestacks would be placed at the side of the ships to allow for the building of flying decks.

Our suggestion would be to construct the ships already converted,



complete with hangars, flying decks and anti-aircraft guns in place. In this condition we think they'd have far more usefulness and appeal to prospective passengers, world conditions being what they are at present. We believe that passengers would come flocking and would be willing to pay much higher prices for cruises advertised somewhat along the following lines:—

"Mediterranean and Far East cruises now being arranged. Anti-submarine and anti-aircraft patrols maintained night and day from upper flying deck. Anti-aricraft gun crews on duty 24 hours daily. Passenger living quarters and promenades below bomb-proof decks. Whippet tanks and machine gun patrols provided for passengers on all short visits. Join our cruises and see the world through a slit in a piece of armor plate."

» NOW THAT the Supreme Court has ruled that the patents of Robert Esnault-Pelterie, of France, on the airplane "joystick" are valid, making the government and manufacturers liable for large royalties on ships built over many years,—we'd say that the device was very appropriately named, from the inventor's standpoint.

» ALL GOOD ENGINEERS and designers seem to have boundless scientific curiosities, and are always anxious to try out the newest development and to redesign their own airplanes almost as soon as they are built. For a good salesman and capable manufacturer, Larry Bell seems to have a remarkable insight into the workings and peculiarities of the minds of engineers. Fred Flader, Ass't Chief Engineer of Curtiss, once told us a story about Larry Bell which illustrates this point:

A few years ago Larry was sitting in on an engineering meeting in which was being discussed the types of construction to be used in a new design. The engineers couldn't agree at all on the type of monocoque to be used for the fuselage, each man advocating a different type. After a long discussion of pros and cons, Larry spoke up and said, "I know one type of fuselage I'm sure that all you engineers would agree to use."

"What's that?" they asked.

"Any type that has never been tried before."

» NEWS PICTURES show Imperial Airways airliners, intended for trans-Atlantic service, being re-fueled by pipe line in the air, from a flying gas tank,—a R.A.F. bomber flying above it. We suppose it won't be long before they've worked out some way of lowering a group of mechanics also, to clean the windshields, check the oil, and refill the radiators.

» OUR STATESMEN seem to have been a lot concerned lately about the "penetration" of the Fascist powers into South America and so we are glad to inform them that there is now nothing to be worried about so far as Italy is concerned. The Italians recently completed a "good will" flight down there,

and we know of nothing which puts more of a strain on diplomatic relations than a good will flight.

» AN A.P. DISPATCH states that a couple of Italian aviators, one of which would be Bruno Mussolini, is planning a flight to Japan from Rome. The route would be around the southern edge of Turkey, through Central Asia and over parts of China now under Japanese control, and the purpose of the flight would be to demonstrate the facility of flying from Italy to Japan without landing in territory controlled by Great Britain and France.

This business of flying cross country without crossing restricted military areas is becoming more difficult each day, and these areas and national boundaries are changing so fast lately, we are wondering if it wouldn't be a good idea to broadcast information regarding them to pilots by radio along with the regular weather reports.

ECONOMY THROUGH COOPERATION

IT IS NO SECRET that the air lines are having hard sledding right now. All traffic indices are down, and competition in certain parts of the country is very keen for what little business there is during the winter months. Literally, the traffic boys are scrambling for customers' nickels. The most disturbing element in the picture, however, is the resulting talk of drastic cuts and economies. Everywhere we hear of reduced schedules and layoff of personnel.

It is considered good business to retrench in bad times, but the real danger for the air lines is in cutting in the wrong places. No air transport operator can afford to skimp on items of maintenance and aids to operating safety. No more short-sighted policy could possibly be adopted than to do anything that might open up the way for another accident at this time.

But there are means of economy open through cooperation if the air lines could only get together to work them out. Costly competitive traffic promotion campaigns could be tossed overboard in favor of a joint publicity campaign that would put back traffic on all the air lines; less elaborate meals might be served in the air. Most important, there are available economies in joint action at many terminal fields. Now that most operators are flying the same equipment, the way is open for a common spare parts pool at many points, thus reducing individual stock inventories. Already at some fields certain air lines are cooperating in the matter of common fire protection equipment. It might even be possible to make joint use of certain items of servicing equipment.

Some of these things are small in themselves, but careful study may open up real possibilities for savings. Who knows, with the current trend toward standardizing of equipment, we may even contemplate the prospects of a common flying equipment pool, and even one or two large servicing and overhaul centers to take care of repair and maintenance for all lines. Utopian perhaps, but possibly something to think about.

MERRY-GO-RUN-AROUND

WHILE THE AIR LINES of the country are struggling to keep their heads above water in what is perhaps the most critical period of their existence (not excepting February, 1934), aviation affairs continue to get a terrible tossing about in Washington. Where several months ago we had begun to think that there was some chance of getting the several factions together on some definite plan for the establishment of a broad gauge aviation policy for the United States, now things seem to be more at sixes and sevens than ever before. It is a rather appalling thought that the whole future of this great industry (or even the future of the country itself, if you think of aviation in terms of national defense) is now being kicked about from congressional scrimmage to congressional scrimmage as a good old-fashioned political football.

Clearly there are too many grandstanders in the game,—too many people who want to carry the ball when they have a clear field ahead and a chance to make a gain for themselves, but who are more than willing to pass it to someone else when the going gets tough, or the crowd is not watching.

We had few hopes that anything important for aviation would get through the late lamented special session, and we were not disappointed. We did look forward, however, to getting somewhere in the current regular session, but it looks now as though we are going to be disappointed again. It looks like the same old merry-go-run-around again.

Meanwhile the domestic air line situation is critical, fixed base operators are jittery over the effects of the CAR on their business, foreign competition is threatening our position in world transport and world aircraft markets, and our service aviation is being neglected. If something isn't done soon to work out a coordinated national policy, things will certainly go badly to pot. Responsibility lies squarely on the White House doorstep. The old game is at one of its turning points right now. Think fast, Mr. Quarterback!

THAT WEATHER AGAIN

SPEAKING before a meeting of the Institute of the Aeronautical Sciences in New York, last month, Tommy Tomlinson, TWA's high altitude researcher, laid an idea down on the table that is worth looking at. After pointing out that the old theory that weather conditions became serenely uniform in the sub-stratosphere was far from fact, he suggested the need of making regular weather flights at a number of points around the country at altitudes up to 30,000 feet or better instead of the commonly accepted 15,000 or 16,000 feet. Obviously in order to do this, special equipment is required, but he suggested that here was a place where the Army's super-charged single seat pursuits could be used to advantage after they have become obsolete for military service. Not only would the government be able to realize considerable return on an investment that will have to be written off anyway, but also the Army pilots who would be assigned to fly regularly to such high altitudes would receive a great deal of valuable experience in sub-stratosphere operations. Besides, the data that they would bring down with them daily would be of tremendous value to the boys who dish up the weather forecasts.

GIVE AC RESERVE A BREAK

CRUISING about the country, our attention has been called more than once to the difference between the operation of the Air Corps' and the Navy's Reserve (as far as flight operations are concerned)—with the score very much in favor of the Navy. Not that the Army boys are less enthusiastic, or less competent individually, but, with the present set up, they are pretty much behind the 8-ball from the start.

It is apparent that Naval Reserve Units are really *units,* that they are trained and ready to meet any emergency *as a unit* on very short notice. The personnel is paid for the time they put in on a scale that takes rank into account and includes the usual 50 per cent extra for flight duty. Then too, pilots can count on plenty of flying time, with 45 hours of so-called syllabus flying required during the year (including at least ten hours of gunnery, nine hours of bombing, seven or eight hours of tactical flying, etc.). During drill periods, the reservists take over and operate in their assigned areas on a full emergency basis.

With the Army, conditions are different. Reservists are not required to fly any specific time during the year, nor do they get any compensation for turning out for drills. The only return available is in flying time, and, for most units, that is seriously restricted by budgetary limitations. While there are exceptions, generally speaking the *esprit de corps* in Air Corps Reserve units is more often than not below that of Naval Reserve aviation.

The real trouble, of course, is lack of funds. It might be a very useful idea for the boys who hold the purse strings in Army headquarters at Washington to consider seriously the differences that exist between the two services, then to set to work to reorganize the Army Flying Reserve on some similar footing to the Navy's. Certainly the Air Corps rates the same break.

"Stage-door" delivery of a Stinson exhibit on Prince Field

"CAVALCADE OF FLIGHT"

Chicago's International Aircraft Show Attracts the Public, Sells Planes.

WHEN Chicago's International Aircraft Show wound up its final session at midnight, February 6, a preliminary count of the gate indicated that more than 200,000 people had visited the exposition during the preceding ten days. It was evident not only that the public had gotten its money's worth, but, judging from the remarks of exhibitors up and down the floor, there was a general feeling that the Show had been worth while from the industry's standpoint. There were complaints, of course, but by and large a general feeling of satisfaction seemed to prevail. Not only had airplane and accessory exhibitors developed a number of valuable leads and prospects, but actual sales of aircraft were reported by Aeronca, Beech, Bellanca, Fairchild, Gwinn, Howard, Lockheed, Piper, Porterfield, Rearwin, Ryan, Stinson, Waco.

Interesting, too, was the fact that the manufacturers of planes in the $4,000 to $6,000 class began to report active inquiries from people who had bought planes in the $1,200 to $1,800 class in the preceding year or two. In other words, it is becoming apparent that the light plane is actually beginning to develop business for the 4 to 6 place people rather than cut into their sales as was feared at first.

AVIATION's Inquiring Reporter turned in the following vital statistics on aircraft at the Show:

Total number of planes on display, 46. Total number of commercial airplanes carryingATCs as follows: high wing monoplanes, single engine, 14; high wing monoplane seaplanes, single engine, 5; single engine biplanes, 4; amphibian single engine biplanes, 1; single engine low wing monoplanes, 2; twin engine low wing monos, 3.

In the non-ATC group, 11.

In the military group were 2 single engine biplanes; 2 single engine low wing monoplanes; and 1 autogiro.

Largest ship in the show was a Douglas DST exhibited jointly by American Airlines, TWA, United Airlines, and Pan American. From early morning until late each night show visitors filed through the ship, most of them thus getting their first look at how this transport aviation has really grown up. Surrounding the Douglas in the main arena were four miniature lakes in which floated (1) a Coast Guard Grumman amphibian, (2) a Howard DGA, (3) a Stinson Reliant, and (4) an Aeronca K, the latter three on Edo twin floats.

Bureau of Air Commerce and NACA exhibits attracted considerable attention. Theirs were the "peep-show" type where the customers could push buttons and see what makes this aviation business tick. Aero-dynamic phenomena and airway aids were featured. Outstanding were the working models of the full-scale tunnel and the high-speed towing basin.

Most visitors seemed to enjoy John Ross Reed's elaborate pageant "Cavalcade of Flight." Its two performances daily were generally packed.

One feature that appealed to exhibitors was the fact that a landing strip was available alongside the Amphitheater on which most of the ships were landed (including the Coast Guard Grumman and the Lockheed 12) under their own power. In spite of inclement weather and a somewhat restricted approach and landing area, all fly-ins were completed without accident.

SHOW SCENES

J. A. Fitz of Sperry, and Grove Webster of Aviation Publishers.

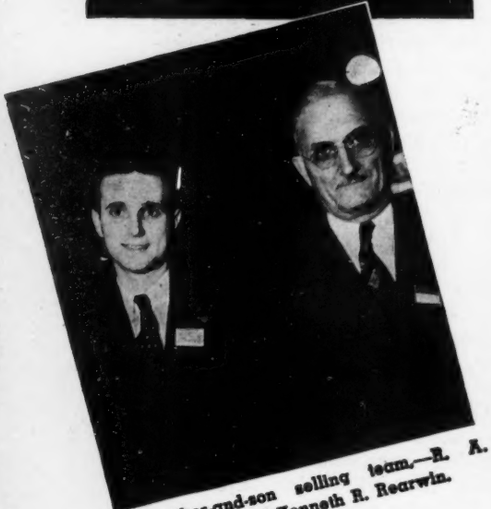
Kollsman featured a transparent panel and a set of instruments with transparent cases to show how the wheels go 'round

Norm Clements of United at work on a potential propeller customer.

Louise Thaden and the editor of AVIATION.

Earl Osborn points out the advantages of float flying.

We couldn't blame Joe Gwinn for his enthusiasm for his Air Car.



A father-and-son selling team.—R. A. Rearwin and Kenneth R. Rearwin.

Nancy Love was active in selling Air Cars for Joe Gwinn.

Sperry backed up an interesting working model of the automatic pilot with a colorful display of air line posters.

Ben Howard points out a few of the features of his projected twin engine, 7-place, DGA-10 to be powered with two geared Menasco C6S4 engines (reported 350 hp. each). Retracting tricycle landing gear is a feature.

Al Essig, of The Essig Company, Ltd.

A customer "gets the works" at the Jacobs Engine Company booth.

Dick Mock, Fokker's West Coast representative, talks things over with Benny Howard.

The Bendix booth displayed the company's full range of products.

He Covers the WATERFRONT

$10,000 a year from a seaplane operation in the heart of the Blue Ridge Mountains

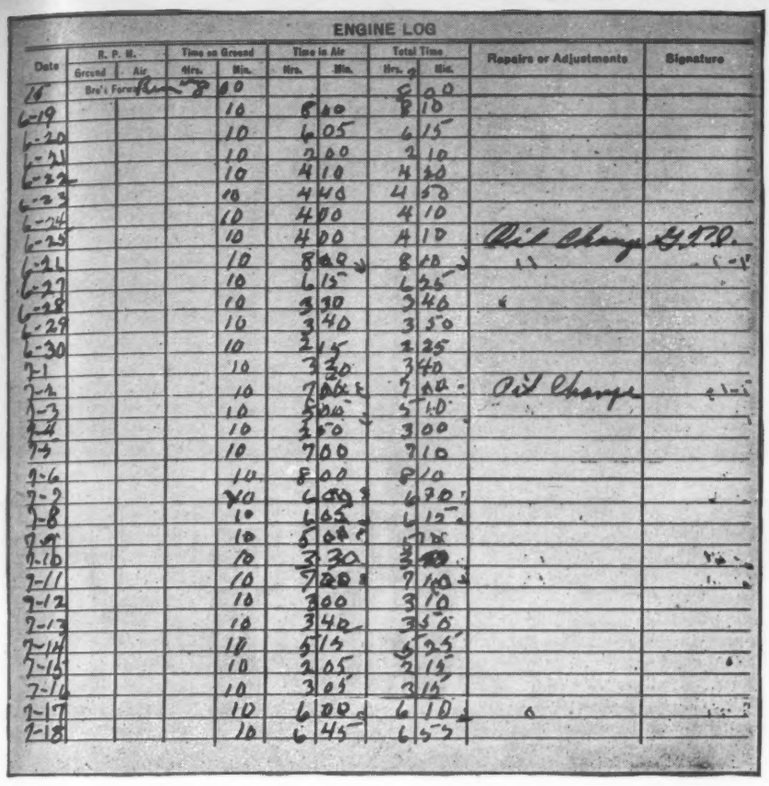
DOWN AMONG THE HILLS of West Virginia, where trees, rocks, and an occasional river are about the only things an airplane can find to land on—there's an operator with an Aeronca on Edo floats who in five years has soloed 129 students, flown seven thousand hours and earned a gross income from flying operations alone, of between $45,000.00 and $50,000.00. Incredible as it may seem, his story can easily be checked and as easily appreciated by anyone who takes the trouble to journey to Charleston, W. Va., and asks the first man he sees about Glenn T. Clark and his seaplane service. As a matter of fact, it is quite obvious that this point about every one knowing him and continually seeing his ship in the air over town, has had more than a little to do with his success.

Way back in 1932 Clark was flying at the local airport—some ten miles out in the sticks. Things didn't seem to be panning out and he decided to see if the idea of seaplane operations, which he had read about, couldn't be made to work. Having no capital he lined up a flying club program to finance the ship, and purchased an Aeronca, one of the very first light planes to be licensed on floats. The Kanawha River provided him, free of charge, with a very nice airport, and he resurrected an old tin hangar and fastened it on a river barge which had been condemned for towing operations. The total cost came to $700.00 cash, plus a certain amount of his own good common sense and labor. That same barge and hangar is still in use today but he expects to sell, and replace it this Winter with larger quarters of the same general type but with the addition of a beer garden, some potted plants and a restaurant on the roof. Clark has noticed that the towns people like to walk down to the city levee to watch his ship fly, and intends to make things more comfortable for them and increase his income at the same time.

The Kanawha Seaplane Service, "Base" at Kanawha & Capital Streets, is exactly a block from the main C & O highway bridge, and about 100 feet or so from the Union Bldg.—the tallest in town. Literally, it is right in the center of things, and quite naturally a bit more conveniently reached than the airport, by customers and on-lookers alike. The customers like it, moreover, because it is not only lots of fun to fly from water, but because good landing fields are scarce in that part of West Virginia.

As they say down there, you can't find much to land on except trees, rocks and water, and pontoons are best on all three—particularly the water!

CLARK kept his original Aeronca for three years and it logged some 3700 hours. During the third year he added a small amphibian but sold it after 100 hours because it was too expensive to operate and not particularly popular. He is flying his third Aeronca now which he purchased



ENGINE LOG

Date	R. P. M. Ground	R. P. M. Air	Time on Ground Hrs.	Time on Ground Min.	Time in Air Hrs.	Time in Air Min.	Total Time Hrs.	Total Time Min.	Repairs or Adjustments	Signature
18	Bro't Forward		7	00			8	00		
6-19				10	8	00	8	10		
6-20				10	6	05	6	15		
6-21				10	2	00	2	10		
6-22				10	4	10	4	20		
6-23				10	4	40	4	50		
6-24				10	4	00	4	10		
6-25				10	4	00	4	10	Oil Change 6.50.	
6-26				10	8	00	8	10		
6-27				10	6	15	6	25		
6-28				10	3	30	3	40		
6-29				10	3	40	3	50		
6-30				10	2	15	2	25		
7-1				10	3	30	3	40		
7-2				10	7	00	7	10	Oil Change	
7-3				10	5	00	5	10		
7-4				10	2	50	3	00		
7-5				10	7	00	7	10		
7-6				10	8	00	8	10		
7-7				10	6	00	6	10		
7-8				10	4	05	4	15		
7-9				10	5	00	5	10		
7-10				10	3	30	3	40		
7-11				10	7	00	7	10		
7-12				10	3	00	3	10		
7-13				10	3	40	3	50		
7-14				10	5	15	5	25		
7-15				10	2	05	2	15		
7-16				10	3	05	3	15		
7-17				10	6	00	6	10		
7-18				10	6	45	6	55		

Glenn Clark knows that airplanes make money only when they are in the air. Here's how he operated his Edo-Aeronca over a 30 day period.

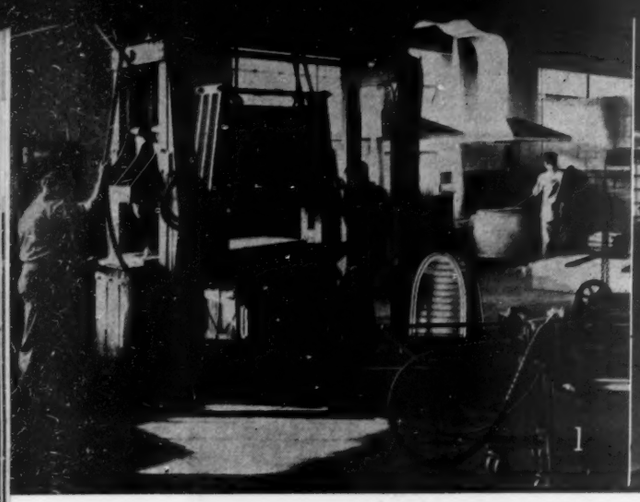
new last June, and had nicely broken it in by October with a log of nearly 600 revenue hours. Just to show how it goes, a page or two from his log book is reproduced—the 30 day period of 147 hours which commenced when he put his latest ship on floats. His price for instruction or student solo time is $7.50 per hour, while he averages between $9.00 and $10.00 an hour on passenger flights.

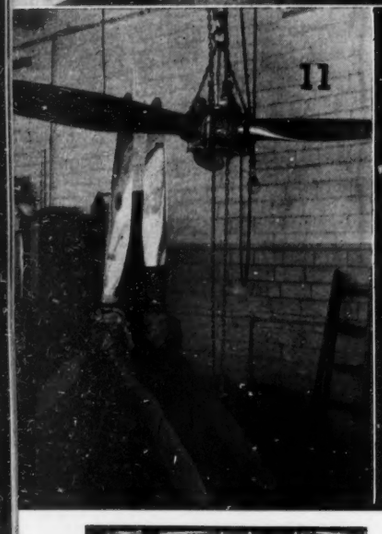
Clark paid off the members of his flying club sometime ago and is running the service on a business basis. He doesn't advertise, doesn't line up the porters, and doesn't put literature on an easel in the hotels. As a matter of fact, his location and the fact that he is operating a seaplane seems to be responsible for bringing in all the customers which he and his personally trained assistant can comfortably handle, but he is planning on a second ship and a definite expansion in all round activities next year, and at that time will probably go after business in more nearly the accepted manner. It's quite obvious, however, that every move he has made had a purpose. Aerial photography, for instance, backed up by a first class camera and dark room has materially added to the income from flying operations. During the floods last Spring he carried doctors, serum, and official inspectors over the inundated areas, while for days at a time he and his ship were the sole means of comunication with many towns along the river. In many cases of emergency his immediately available service has obviously been an asset to his community.

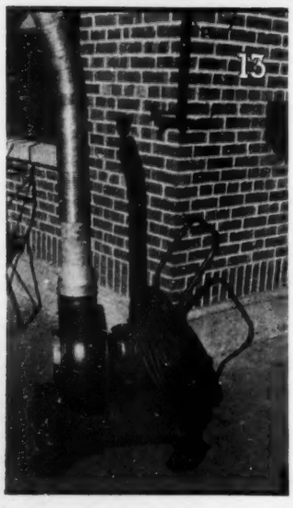
As a side line, Clark runs an outboard motor boat service. On rainy days he builds boats, and overhauls engines for the 8 or 10 customers who tie up their craft at his float and store their motors and gear in a part of his hangar. It's just an additional feature which ties in with water flying and adds to the $10,000.00 a year revenue from his strictly seaplane activities. Another secret of his success is the efficiency with which he uses his equipment and handles his operations. The hangar, for instance, which is built on one end of the barge, is only just big enough to hold the ship if moved in sideways, since its width is limited by the width of the barge. For this reason the ramp is built on the side of the open end, and the ship hauled out on its keels and upon a very low four wheeled dolly, which carries it sideways through the hangar door.

There's a very low float, along the open side of the barge, made of 12"x12"s spiked together. It supports the lower part of the ramp which is hinged at the deck, and makes a grand thing for students in either outboards or seaplanes to approach, because a head on contact simply noses the job out of water—the free board is so slight. Of course, it would be wet on rough water but it works perfectly on the Kanawha. Incidentally, the barge is a wonderful rig to work from, in waters where sudden and drastic changes in level take place, for Clark simply moves it up or down the levee for floods or droughts. Just think of getting away with a ten foot ramp in a place that has forty foot tides, and always having things right.

There are literally hundreds of Charleston, West Virginias' around the country. Many of them, of course, offer different operating conditions. In some spots it is probable that a larger, more powerful ship would do a better job, if unusually rough water prevails. In others it might be more economical to store the plane out of town, and fly it in every day to an operating float in the heart of the city. Those are questions for the Glenn T. Clarks to decide. But a quick glance at any map will convince any resourceful operator that there is an almost unlimited amount of virgin territory where the West Virginia plan can be adapted. And in these days of keen competition, with the airlines crowding the operators and private pilots off more and more airports, it is obvious that the seaplane idea is proving to be a guide post which many a pilot will profitably follow next year.





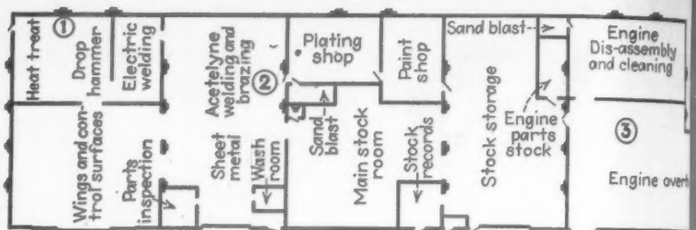


1. Drop hammers have been found economical in maintenance as well as in manufacturing.

2. The welding shop is well lighted (Cooper-Hewitt lamps), kept clean at all times.

10—11—12. The propeller shop is well lighted, is well fitted up with overhead trolleys and portable racks for easy handling of large blades and hubs. Adjacent grinding and polishing rooms are ventilated by powerful exhaust fans to handle dust. The portable hydraulic jack (12) has proven a most useful propeller handling gadget.

13. A portable blower with flexible connection blows fresh air into standing ships on hot days.



CHEYENNE

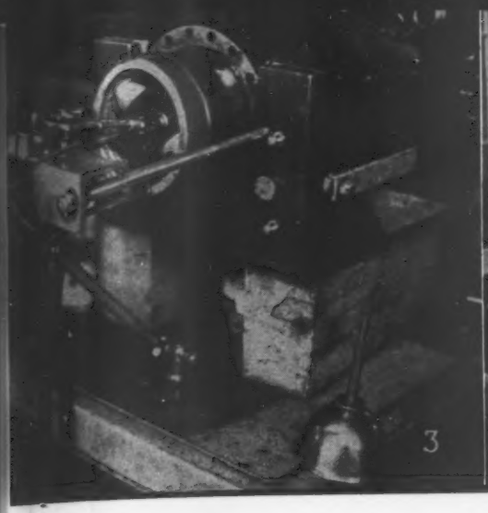
A picture trip through United Air Lines' efficient and modern overhaul base.

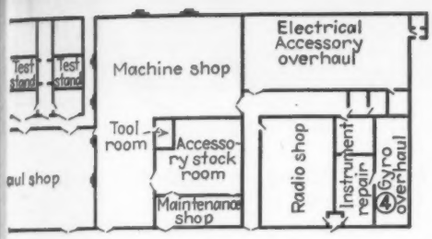
UNITED'S LONG ESTABLISHED MAINTENANCE CENTER at Cheyenne (Wyo.) has not only had its face lifted by the revamping of the exteriors of its buildings, but within the past twelve months all shops have been rearranged and re-equipped, so that to-day it stands as an example of the best and most efficient in the servicing and overhaul of transport planes and engines. Periodically every bit of equipment, large and small, of UAL's far-flung system passes through it, coming out again into service "as good as new".

The service hangar stands in approximate relation to the other shops as shown on these pages. It serves not only for routine inspections and day-to-day checks, but also as a dis-assembly and re-assembly department for overhauls. There the ships are stripped of engines, propellers, instruments, radio, fittings, etc., and the parts distributed to the appropriate overhaul shops. A new Baker-Rauling crane type electric truck has been found very useful in handling such parts across to other buildings.

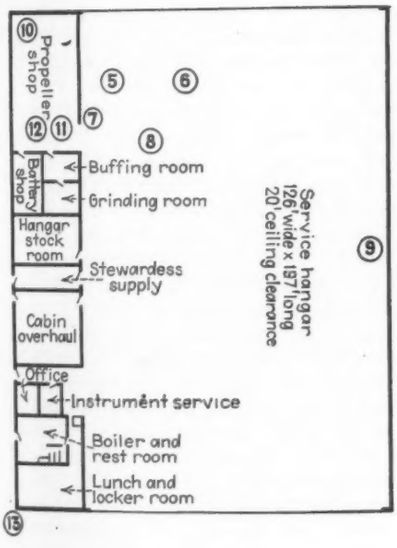
All overhaul shops have been laid out with an eye to straight-line production methods. The engine shop is especially note-worthy in this respect, with motors moving through from tear-down, cleaning, inspection, re-assembly into test house, from crew to crew, efficiently and smoothly aided by a modern overhead trolley system.

An interesting project is being completed in both the instrument and radio shops. All test equipment is being standardized and mounted permanently on standard relay panels, an idea that should clear away some of the wierd and wonderful test set-ups that are now to be seen in many overhaul shops.





GLIMPSES



3. Close-up of an automatic tool for lapping piston rings in cylinders. Compressed air furnishes power for operation.

4. Each instrument man has own bench fitted with special tools, vacuum, air and electric outlets.

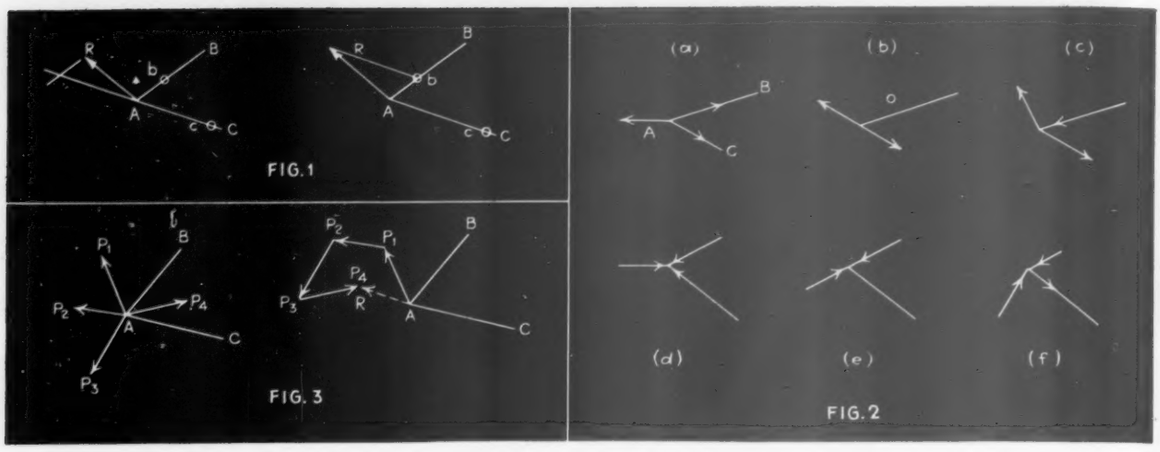
5. A gallery along a wall, provided with drawbridge-like extensions permits servicing Douglas noses.

6. Bolted-on stands of steel tube keep wing panels off the floor and a working height.

7. A small motor operated vacuum pump deflates big tires for easy removal of tube and shoe.

8. A discarded station-starter provides power for main jacks for undercarriage servicing.

9. Everything ahead of the fire walls may be assembled in place on these engine mount jigs before swinging entire units into nacelles.



SOLVING SPACE STRUCTURES GRAPHICALLY

Part II

Application of the Method

By Elias Moness

Engineer, Structural Research Department, Douglas Aircraft Company

AN ENGINE MOUNT STRUCTURE will be solved graphically by means of the method explained before. (See AVIATION, December, 1937, page 30.)

The four trusses making up the structure are all different from one another. (See Fig. 4 and 5) Therefore, we must show separate views for each truss; the side trusses are shown in the same view with the members of the inner truss shown in dotted lines wherever they do not coincide with the corresponding lines of the outer side truss. The bottom truss is shown in plan view; thus it is easier to keep the direction of applied loads correct.

It will be seen that none of the trusses is a plane structure. This makes it difficult if not impossible to use the ordinary graphical method in which each separate truss is dealt with as a plane structure.

The present methods differ basically from the above by treating the structure as a true space structure and by dealing with all the members at any joint simultaneously, regardless of their direction or of the planes they are in.

Space loads can be applied at any joint by means of the two projections which are necessary to represent them completely.

It must be emphasized that in most cases any one view will not show all the members at a given joint; it must be kept in mind that there are other members ending at this joint and these are shown in some other view; as an aid in realizing the space nature of each joint it is advisable to draw a freehand isometric sketch of the structure and to refer to this sketch in dealing with that particular joint. (See Fig. 5)

In the present case a space load is applied at each of the four end joints. The vertical loads at joints (1) and (3) are 1820 lb. acting down; those at (2) and (4) act in the opposite direction; the side loads at (1) and (2) are 1260 lb. and act outboard; those at (3) and (4) act inboard.

The loads at the four joints are laid off scale and their direction is marked by arrow heads.

The following three operation are performed over and over again and are therefore explained in detail.

1. In finding the stresses in two members at a joint for a given resultant R, the method employed is to draw a line parallel to one member thru the tail end of R and another parallel to the other member, thru the front end of R. Fig. 1 shows two possible ways of doing this.

2. A simple rule for determining the nature of the stress (tension or compression) is as follows. (See Fig. 2.)

When the line of action of the load falls between the two members (or their prolongation) the stress in both is of the same character, (tension in case *a* and compression in case *d*). When the line of action coincides with one of the members, that member resists the entire load, while the load in the other member is zero, (Case *b* and *e*). When the line of action is outside the members (or their prolongation) one member will be in tension and the other in compression (case *c* and *f*). Inspection will show which stress is in each member.

WHEN applying the various components of the final load acting at a given joint, care must be taken that the tail end of any component should coincide with the front end of the previously applied component, as shown in Fig. 3.

The resultant R is drawn from the joint to the front end of the last load vector and points toward the latter. We can now proceed to solve the structure.

Starting the solution at (1) we notice that this joint has three members: *A*, *C* and *E*; in the side view *A* and *E* are superimposed on each other while *C* is the single member. This joint can be solved as case 4; we draw thru the front end of the load vector a line parallel to *A* and *E* and obtain directly the side projection of the stress in *C*; this intersection point *c*, is projected to the top view and marked with a small circle. The stress in *C* is compression; arrows are placed at each end of *C* pointing towards the respective joints. At this moment it is useful to remember that the stress in *C* will appear as an applied load at joint (11). It is therefore advisable to scale off with the aid of dividers the stress at (1) and to lay it off at joint (11). A little circle will mark its magnitude and two little arcs extending towards (11) will indicate that the length of the stress vector is to be measured between the circle and the joint (11).

The horizontal projection of P_1c is applied as a phantom load at (1) in the top view. It is directed to the left, as a tension load, since the phantom member *A* and *E* in the side view was in tension. A small circle marks the end point of this applied phantom load; to account for the load P_2 we draw thru the last point a line parallel to P_2 and lay off this load on the line. Another small circle marks the end point of this load. To account for the side component of the stress in *C* we draw a horizontal thru (1) in the top view and project on it the stress in *C* in the top view. It is for this that we marked the point c_s when we found c in the side view. The side component is $c_s c_s$ and it acts inboard (since *C* is in compression, and the arrow in the top view would point towards the inboard side).

The resultant of the three applied components is found by drawing a line from the joint to the last circle drawn (the end of the last component).

An arrow is used to mark the direction of this resultant, and a check mark is made on it to make it easily recognizable among the other lines at this joint. A line parallel to *E* is drawn thru the front end of the resultant to its intersection with *A*; as before, the length 1-a, is scaled off and laid off at joint (8). A small circle with the two small arcs referred to before mark its magnitude; arrows at each end of *A* and *E* show compression in *A* and tension in *E*. In laying off R-a at the joint (1) it will be noticed that the stress vector is longer than the member. The member *E* is, therefor, extended (by a light line) beyond joint (1) and the small circle is marked on this extension line; a circle with arcs on an extension line always indicates that the stress is to be measured to the farther end of the member.

It is preferable not to scale the stresses right away, but to continue the graphical solution to its very end and then to proceed with the scaling of all the stresses.

Joint (2) is solved very much like joint (1) but the direction of the vertical applied load being opposite to that of P_1 the signs of the stresses in *C'*, *A'* and *C'* are all opposite to those in the corresponding member at (1). The side load has the same direction at both joints, but the structure is inverted at (2); see solution of joint (3) and (4).

THE REMAINDER of the upper truss in the first bay is a plane structure, and it is convenient to continue right now with its solution. Joint (6) has three members; we cannot solve it unless we first solve joint (7) which has only two members. There is only one applied load at (7) and that is the compression in E'; a line drawn thru the front end of this stress vector and parallel to member *F* and another line thru the tail of the stress and parallel to *H'* give the respective stresses. The *H'* stress vector is longer than the member; both members are in compression. Now that *F* is an applied load at (6) we have only two members at (6) and we can solve that joint. Fig. 4 shows how this is done.

Note the manner in which the resultant applied load is found; how its direction is marked; the distinguishing check mark and the solution for the stresses in *G* and *H*.

We cannot proceed to solve joint (8) or (9) because each of them has more than three members (see isometric sketch). We therefore return to the front end of the structure and solve joints (3) and (4).

Joint (3) is very much like joint (1). *B* in side view is the single member; P_3b is the side projection of the stress in it; in the bottom view the resultant combines the horizontal projection of P_3b, the load P_4 and the side component of the stress in *B*; a line thru R_3 parallel to *J* gives the stresses in *J* and in *D*. These are marked and laid off at joints (5) and (11) respectively. Joint (4) is

(Turn to page 68)

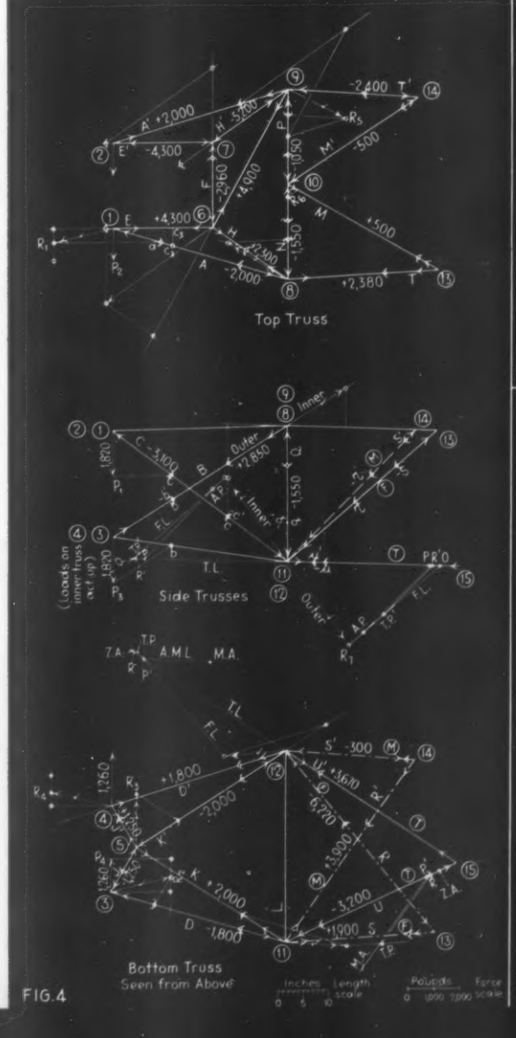


FIG. 4

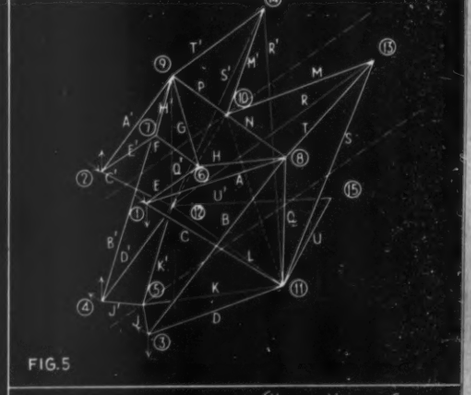


FIG. 5

FIG. 6

Putting the finishing touches on the center section of the wing before removal from the jig.

DC-4 Takes Shape

Rapidly nearing completion in the Douglas plant at Santa Monica is the first of the 4-engined land transports engineered by and contracted for jointly by United, TWA, American, North American and Pan American.

ALTHOUGH IT IS DIFFICULT to pin Harry Wetzel or Arthur Raymond or any other Douglas official down to anything more definite than "early this spring" for flight tests on the DC-4, it is a known fact (and we offer these pictures in evidence) that the construction work on the big ship is better than 90 per cent complete. It is a fair guess that the big job may be out of doors and into the air some time during April.

The vital statistics on the ship (span 138 ft. 3 in.; length, 97 ft.; height 24 ft.) are impressive enough, but a glance at the photograph of a couple of scale models on the opposite page tells the story more graphically. Its gross weight is 64,000 lb., or nearly three times that of the present DC–3. Useful load is expected to be 20,000 lb., which will take care of 42 passengers, a crew of five, 6,500 lb. of mail, express and luggage plus fuel. Although no figure has been given as yet, its top speed will very likely be well above the 220 m.p.h. mark at critical altitudes. Design landing speed is 68.5 m.p.h.

The prototype machine will make its initial flights and will undergo its

Note typical Douglas windshield design, also the opening under the cockpit for the nose wheel mounting.

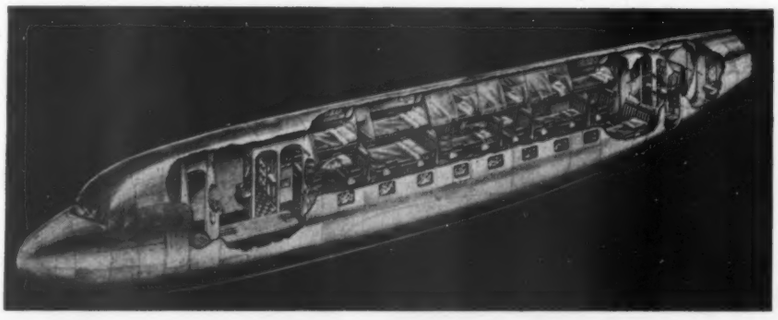
One of the 66-in. diameter main landing wheels fits into this recess in the under part of the center section.

Looking forward along the hull as it lies in the assembly jig.

acceptance tests with four Pratt & Whitney twin-Hornet engines, delivering a total of 5,500 hp. for take-off. Provision has been made in the contract and in the mounts for alternate installation of Wright engines.

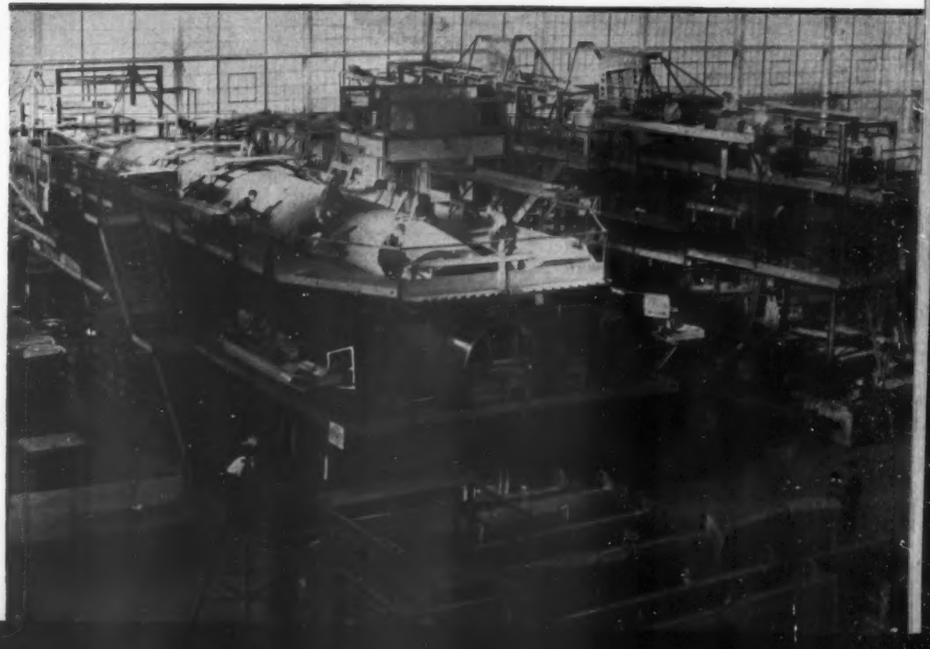
Although the ship will be tested as a normal airplane, provision has been made for supercharging the cabins of production models to maintain low level cabin pressures at high altitudes.

Notes for "Believe it or not" addicts: Cost of development to date of completion of prototype, $1,500,000. . . . More than 500,000 engineering man-hours are tied up in the first machine. . . . Available take-off power exceeds by approximately 1,000 horses the output of most of America's finest streamlined locomotives. . . . With one engine dead, the DC–4 can maintain level flight and clear the highest mountain in the United States by nearly 5,000 ft. . . . The Douglas testing laboratories were busy for more than two years developing required information on materials and design; more than 100 major structural tests to destruction were conducted; over 21,000 engineering and shop hours were used to prove and to check engineering designs and stress calculations.



Layout for the DC-4 cabin made up as a sleeper plane.

By way of contrast, scale models of the DC-3 and DC-4. Note difference in attitude on the ground due to the tricycle landing gear.



General view in the Douglas shop showing fuselage and wings in the assembly jigs.

Flying Equipment

Flying Equipment

Federal Trainer

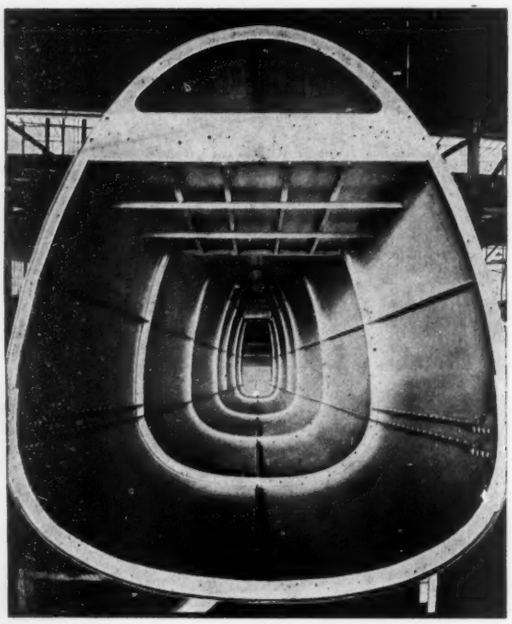
Two-Place Military Primary Trainer Built to Air Corps Specifications now available for export

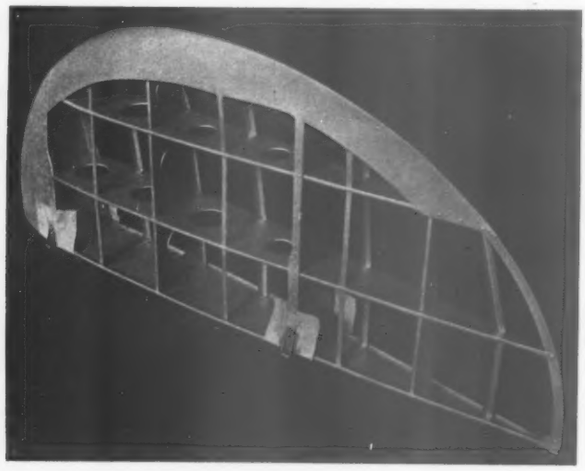
AN EXPERIMENTAL PRIMARY TRAINING PLANE with a number of interesting structural characteristics has been designed and built by the Federal Aircraft Corp. of Lindenhurst, L. I., N. Y. under the supervision of L. Charles Cox and Murray Berkow. The machine is powered with a Wright 760 ET Whirlwind engine developing 225 hp. at 1900 r.p.m.

The fuselage is in two parts bolted together just aft of the rear cockpit. The forward portion is of welded steel tube covered entirely by sheet aluminum alloy. Interesting feature is the fact that the fuselage covering panels are attached by means of Dzus fasteners, easily removable to give access to controls or equipment for maintenance and adjustment. The rear portion of the fuselage is of a semi-monocoque, all-aluminum alloy construction.

The landing gear is full cantilever type hinged at the lower longerons. A torque arm extends vertically upward from the upper end of each leg and oleos are attached to the torque arm and to the fuselage structure at the center line of the airplane just below the thrust line. The legs are faired with quickly detachable aluminum alloy sheets. General Streamline wheels with mechanical brakes are fitted. The tail-wheel is also by General with standard arm type steerable knuckle.

The wings are constructed of 24 ST aluminum sheet, fabric covered. The leading edges are covered with aluminum sheet, riveted to the front spar and to the nose ribs. Double drag wire bracing is installed. Ailerons are in the lower wing panels only and





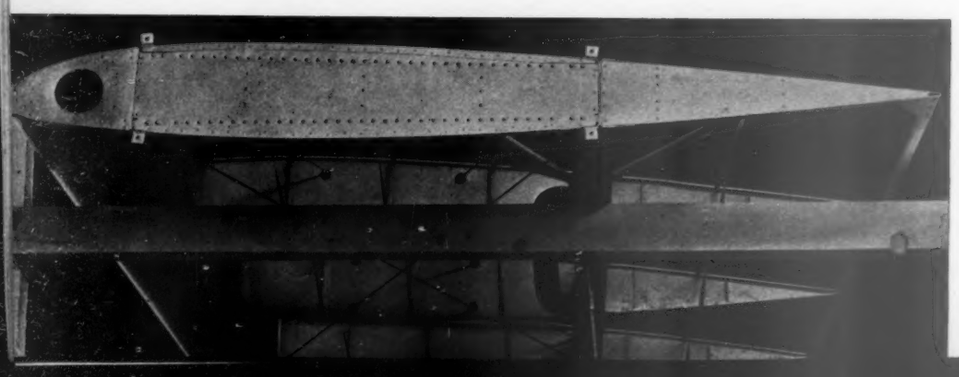
Above: One of the removable wing tips.

At left: Monocoque section of fuselage looking aft.

Below: Wing framing showing metal ribs and aluminum alloy leading edge.

Detail of tail wheel assembly.

Below: Detail of main landing gear showing relation of legs, shock struts and fuselage.



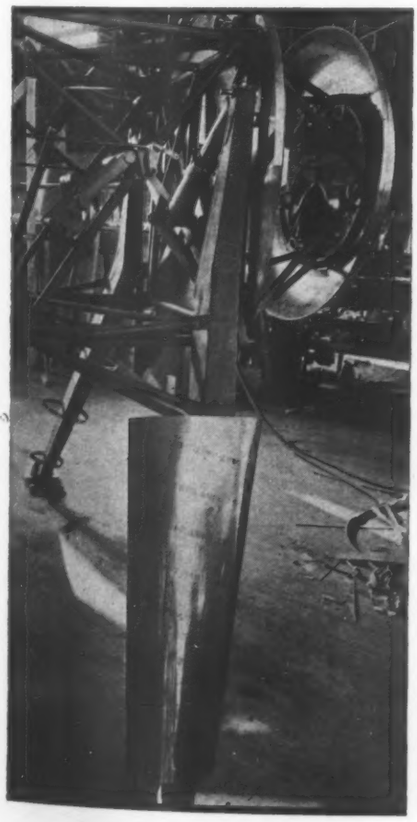
are interchangeable. Interesting maintenance feature is the removable wing tips which are constructed separately and are attached to the main panels by external tension bolts. Upper and lower wing tips are interchangeable. In case of damage to the wing tips, they are easily removed and replaced. All hinge pins and attaching bolts for main assemblies are either outside the skin or just inside the skin line so that no cover plates need be removed or access doors opened for inspection and maintenance.

The wing truss is composed of a single lift strut with N-type interplane struts. This arrangement makes rigging much more positive than through the use of wires.

In test flights at Wright Field (Dayton) it was reported that the machine was very maneuverable and although it will not spin involuntarily, it may be spun deliberately with easy and positive recovery. It is said to be able to clear a 50-ft. obstacle after a run of 750 ft.

The specifications and performance figures given by the manufacturer for a gross weight of 2820 lb. (including two pilots and 40 gal. of fuel) are as follows:

Weight empty .....2120 lb.
Useful load .....700 lb.
Fuel capacity .....40 gal.
Oil capacity .....4 gal.
Upper wing span .....33½ ft.
Lower wing span.....30½ ft.
Total wing area .....308 sq.ft.
Overall length .....25 ft. ½ in.
Overall height .....10 ft. 7 in.
Tread of landing gear (normal)..109 in.
Maximum speed (sea level) ..128 m.p.h.
Stalling speed (sea Level) .....42 m.p.h.
Rate of climb (sea level).800 ft. per min.
Service ceiling .....17000 ft.
Endurance at operating speed....4.05 hr.
Range at operating speed .....405 mi.
Maximum range .....566 mi.



Noorduyn Norseman

Well known American designer turns out a load carrier for Canadian service that is attracting wide attention among back-woods operators.

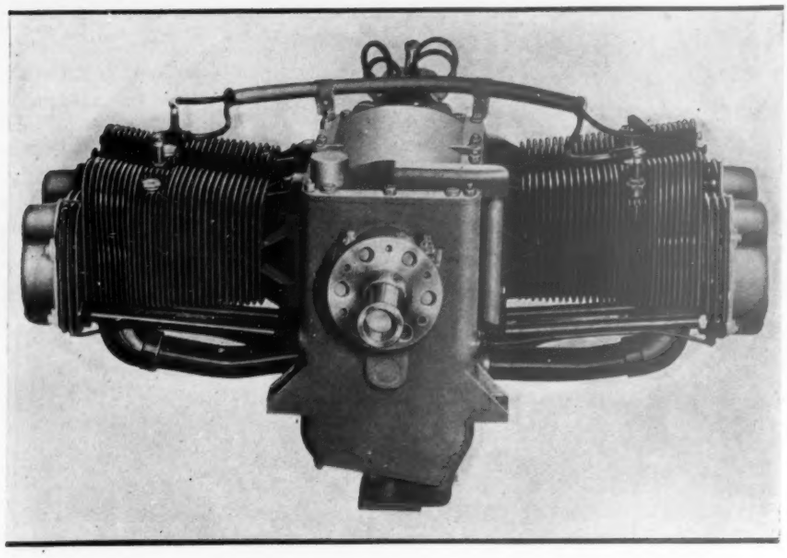
DESIGNED AND BUILT to meet the wide variety of conditions encountered by the commercial operator in Northern Canada, the Noorduyn Norseman is now offered in an improved version featuring many minor refinements incorporated as the result of operating experience.

The "Norseman" made by Noorduyn Aircraft Ltd., Montreal, Canada, is primarily a single engine, high-wing strut-braced cabin monoplane of mixed construction. Normal passenger capacity is nine plus the pilot. Although the Pratt & Whitney Wasp Type S3HI of 550 h.p. is standard equipment, the Wright R975-E3 engine of 420 h.p. is also offered, together with the Hamilton-Standard controllable propeller.

Not only is the "Norseman" available with two different power plants, but it is also designed for use from land, snow, or water; being optionally fitted with wheels, skis, or floats. Also in line with its all-purpose nature the "Norseman" has been built to operate as either a freight or passenger plane, with further provision for service as an ambulance plane, for aerial photography, troop transport, or luxurious private owner accomodations.

Specifications as a landplane:

Span—51 ft. 6 in.
Length—32 ft.
Height—10 ft. 3 in.
Wing area—325 sq. ft.
Weight empty—3675 lbs. as freighter; 3733 lbs. as passenger plane.
Disposable load—2775 lbs. as freighter; 2717 lbs. as passenger plane.
Gross weight—6450 lbs.
Powerplant—Wasp S3HI engine—550 h.p. at 5,000 ft.
High speed at 5,000 ft.—170 m.p.h.
Cruising speed at 5,000 ft.—150 m.p.h.
Landing speed, full load—55 m.p.h.
Range (variable with load)—390 to 870 miles—normal full load range, 600 miles.



FRANKLIN AC—150

A new engine with an old name for light aircraft.

AIRCOOLED MOTORS CORPORATION, Syracuse, N. Y., announce a new engine for light aircraft on which ATC tests are now under way and which is scheduled to start production early in March. The new engine has been developed by the former engineering chiefs of the old Franklin Automobile Company. The present company owns the Franklin name, trade-mark and patents.

The AC-150 engine has $3\frac{1}{8}$" bore and $3\frac{5}{8}$" stroke, giving 150 cu.in. The idea of keeping the stroke-bore ratio at unity was to keep the piston speed down to a minimum.

The crankcase is of a high strength aluminum alloy with a removable top cover which acts as the truss member for tying the top together.

Main bearings are of the interchangeable type, steel backed with babbitt lining. The propeller thrust is taken on the long bearing next to the propeller.

The oil pump is submerged beneath the level of the oil and incorporates aluminum housings with duralumin gears. In the pump housing is located the relief valve which has a fixed adjustment, the adjustment being set to open the relief valve at 50 pounds pressure.

The engine is full pressure lubricated throughout, including valve rockers. Being a wet sump type engine, the need for extra tanks and plumbing for the oil system is eliminated.

Cylinders are individually cast with the valve rocker box an integral part of the casting. These castings are of British "Y" alloy.

Into the cylinder is shrunk a ni-resist liner which has a coefficient expansion of .00001 as against .0000123 for the cylinder casting.

Valve seats and the exhaust valve guides also are of ni-resist cast iron, both of these having a shrink fit of approximately .0035. The intake guide is of ordinary cast iron and the exhaust guide is of nickel and chrome.

Each cylinder has a single rocker box enclosing two Wilcox-Rich valves, each of which has a different axis. In other words, the valves are staggered slightly in order to provide sufficient area for the air to flow across the engine properly.

The rocker arms operate through bronze bushings on hollow hardened pins through which oil passes to lubricate the entire valve mechanism.

Each cylinder has a provision for two spark plugs, both mounted on the top side of the engine. Both spark plugs are located in a recess.

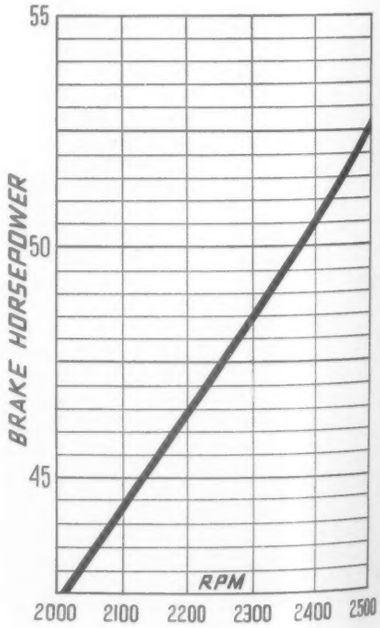
The intake valve has a clear diameter $1\frac{1}{2}$" and the exhaust valve $1\frac{7}{16}$". The lift of both valves is $\frac{3}{8}$" with valve stems $\frac{3}{8}$" in diameter. Dual valve springs are used with the small inner spring stressed very low and used chiefly as a safety measure in case of failure of the outside spring. Each valve is operated by a rocker arm and a push rod in the Wilcox-Rich hydraulic lifter which is enclosed against possible oil leakage.

Hydraulic valve lifters are controlled by engine oil pressure and automatically compensate for the expansion of valve gear up to .200 backlash. They eliminate valve maintenance between main overhauls, increase valve gear life by reducing backlash.

Oil from the pump is forced through to headers and on to the hydraulic unit where clearance is properly adjusted. The initial clearance at the valve stem is set at .040, which, of course, is eliminated as soon as the oil enters the system.

The one-piece, forged alloy steel, four-throw crankshaft has four counterweights and is drilled for lightness and pressure lubrication of the crank pins and main bearings. One of the unusual features of the crankshaft is the fact that the propeller inner flange

(*Turn to page* 42)



Flying Equipment

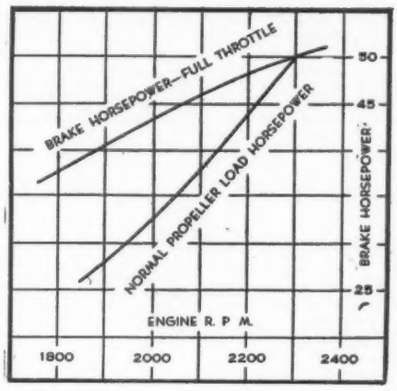
LYCOMING O-145

Aviation Manufacturing breaks into 50 h.p. class

SWELLING THE TOTAL of the major engine manufacturers now offering powerplants in the 50 h.p. class, Lycoming announced the O–145 engine at the recent Chicago Show. As are the other engines in this power range, the new Lycoming is a four cylinder four stroke cycle horizontally opposed engine. However, there are numerous points of difference between the new Lycoming and other 50 h.p. engines, which make this an unusually interesting powerplant. Designed for economical production and maintenance, the O–145 is of overhead valve type. Most noticeable design feature is the casting of cylinder banks and crankcase sections as units. The crankcase is split on the center-line, and each half of the case together with each bank of two cylinders is cast in one piece of semi-steel. A ground finish, metal to metal contact, makes possible assembly of the two halves into a very rigid structure. Ease of maintenance is assured by provision of removable top cover and bottom pan.

The internal webbing, and crankcase walls support the three replaceable steel backed babbitt-lined precision type main bearing shells which carry the crankshaft. The shaft is a one piece steel forging drilled for lightness and pressure lubrication to main and connecting rod bearings. Four throws are incorporated, with three main bearings to provide rigid support. A spur gear driving the camshaft is attached to the rear of the crankshaft by dowels and screws.

Two-piece forged steel connecting rods are provided with bronze bushings at the piston end and babbitt-lined bearings on the crank pin end. Cylinder heads are independent aluminum alloy castings attached to the cylinder block by studs and nuts, with soft aluminum and copper gaskets and a small pilot diameter in the cylinder head to prevent leakage at this point. Valve gear is fully enclosed, both valve rockers being accessible by removing a single cover attached to the head by studs and nuts, while the push rods are enclosed by a one-piece tube held between the head and case by the head attaching bolts. Pistons are of LO-EX aluminum alloy ribbed under the head and machined for



three compression rings above the piston pin and an oil control ring in the skirt. The full floating piston pin is located by means of aluminum alloy buttons inserted in each end. The induction system incorporates the "center zone" principle with the distributing portion of the manifold cast integral with the oil pan portion of the case and constantly immersed in oil. Each cylinder has a separate intake pipe of steel tubing attached at both ends with rubber tubing and clamps.

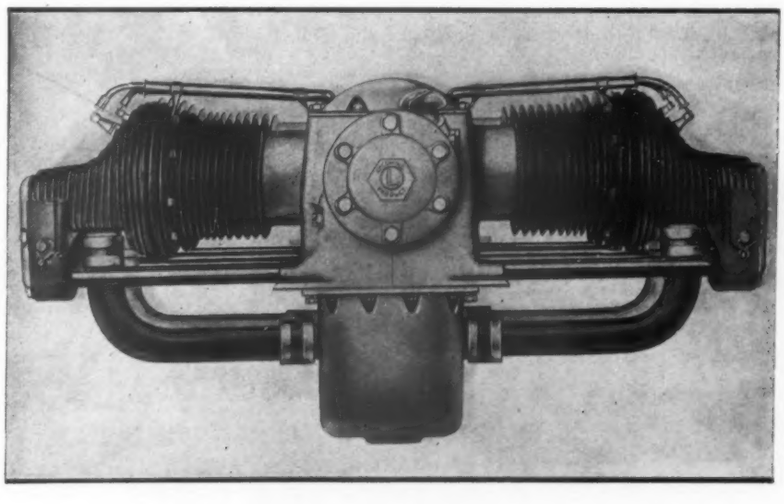
Lubrication is under pressure from a gear pump to all main, connecting rod and camshaft bearings and to the accessory case. Valve gear is lubricated automatically and piston and piston pins are lubricated by spray. An oil baffle strainer is located between the oil pan and crankcase. To permit proper venting a ball-check vent is provided in the top cover.

The camshaft is a one piece heat treated alloy steel forging drilled for lightness and for oil passages. Mushroom type steel cam followers operate directly in the crankcase section. Push rods are of steel tubing with hardened ball ends. Forged steel rocker arms are supported on full floating pins.

A feature of the engine is provision of four platform type mounting bosses cast integral with the crankcase and readily adaptable to use of rubber bushings. This type mount permits removal of engine attaching bolts without use of a lift hoist. The propeller hub rear flange is forged integral with the crankshaft. A small pilot on the hub rear flange locates the propeller hub accurately. Six through-bolts are used to clamp the hub to the flange and dowels pressed into the rear hub flange drive the propeller.

A Scintilla SF–4L magneto is mounted on the rear of the engine and is driven from the rear end of the crankshaft. The gear type oil pressure pump is driven from the rear end of the camshaft. The standard tachometer connection is on the camshaft centerline at the rear of the engine. A Bendix-Stromberg NA–S2 carburetor is attached at the bottom.

Bore	3⅜ in.
Stroke	3½ in.
Compression ratio	5.75 to 1
Piston displacement	144.5 cu. in.
Power rating (sea level)	50 hp. at 2300 rpm.
Magneto	Scintilla SF–4L
Spark plugs	BG or Champion
Carburetor	Stromberg NA–S2
Octane fuel required	73
Fuel consumption (cruising)	.60 lb. per hp. hr.
Oil consumption	.025 lb. per hp. hr.
Weight dry	150 lb.
Shipping weight	260 lb.
Overall height	19 25/32 in.
Overall width	29½ in.
Overall length	23⅜ in.
Mounting bolts	four (⅜ in. dia.)
Distance between bearers	8½ in. wide by 10¼ in. long.



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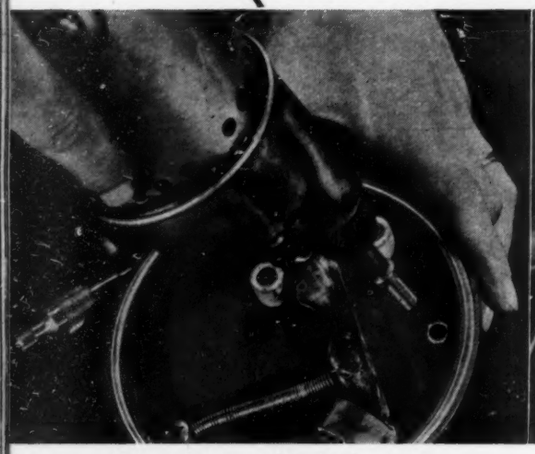
Gains Time

Guides Driver

Guards Work



Faster work with half the pressure

One-hand starting and driving — other hand free to hold work. Three times the purchase of a slotted screw. Faster driving method cuts time to a fraction.

As easy as pointing your finger

The driver's point fits the screw's recessed head. Awkward places easy to reach—the screw won't drop off. Self-centering—straight or at an angle —no screws driven crooked.

Better work — and no spoilage

The driver can't slip out and scar costly material or the fingers. No broken heads — no burrs to remove. Better holding power — the screw sets up much tighter.

Given the acid test by certain key firms in the screw-using industries . . . plants where production costs are watched with an eagle eye — where quality is right and there's no excuse for waste —

The Phillips Screw *with the patented recessed head* has been okayed, after all sorts of time, motion and quality studies, by executives, engineers, purchasing managers, workers.

Now the production facilities of the screw manufacturers have been enlarged — and we're in a position to meet the demands of any plant that has use for screws.

Take the job the picture shows. There the Phillips Screw saves time — and screws — and strength — and spoilage — and money.

Faster work. Use power drivers or higher speeds where power is already used. No need to steady the screw, it steadies itself. No burrs to remove afterwards.

Greater holding power — assemblies are more solid, and often fewer or smaller-diameter screws will do as well. No broken heads — no screws dropped. Greater driver and bit life — fewer sizes needed.

Easier work. The screw helps out. No push and turn — just turn. Maximum contact — minimum muscles. Men are fresher toward the end of day.

Better looks. The driver can't leap from a Phillips Screw to dig a channel across the work. No gnarled slots — no scarred fingers. And the screw is flush with the surface.

What's your fastening problem? Find out what the screw with the patented recessed head can do! Send the coupon to one of the firms listed below . . . mention the type of work you expect screws to do . . . they'll send you folder A, telling you how well the Phillips Screw *with the patented recessed head* has done that work for others.

SEND THIS COUPON TO ONE OF THE FIRMS LISTED AT RIGHT — FOR SPECIFIC FACTS ON PHILLIPS SCREWS — NO OBLIGATION.

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Company .....

Address ..... *Product* .....

This is the Patented Phillips Recessed Head

Note the tapered slot — its angle was worked out after months of tests to find how to utilize the driver's maximum turning power. Note the flat surfaces — no curves except at the rim. That prevents the driver from burring the screw. Machined to tolerances of plus or minus .001" — to guarantee a perfect fit. Hand, spiral, or power drivers may be used — available from leading manufacturers and distributors.

MACHINE SCREWS SHEET METAL SCREWS STOVE BOLTS WOOD SCREWS

PHILLIPS RECESSED HEAD SCREWS

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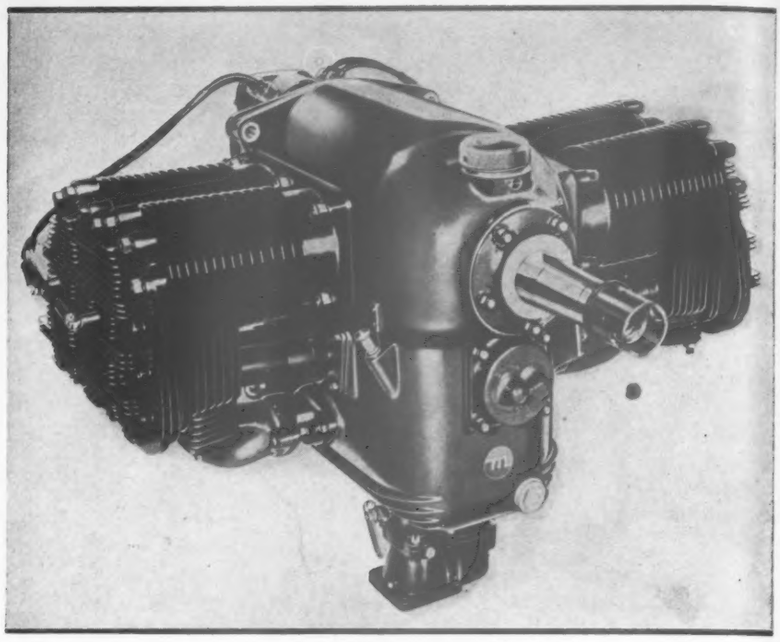
M-50

Menasco Enters Fifty Horsepower Engine Field



FOLLOWING THE WELL established light engine pattern, the Menasco Manufacturing Company is offering a 50 hp. engine of four cylinder horizontally opposed type.

ATC No. 191 has been granted with an official rating of 50 hp. at 2500 rpm. at sea level. Weight is 160 lb., displacement 144.4 cu. in., bore 3½ in., stroke 3¾ in., and compression ratio 5.25 to 1. Substantial orders are reported by the manufacturer (see Aviation News, page 56).

Characteristic is the one-piece cast light alloy crankcase, with integral oil sump and induction manifolding. Crankshaft and camshaft are assembled to the case from the rear, the crankshaft being mounted on two bronze bearings. The front bearing is located directly in the case. The rear bearing is supported to the case by a circular plate bolted in place.

The one-piece steel crankshaft is of three throw type, the center throw being common to two connecting rods. Bolted directly to the rear of the shaft, the camshaft drive gear is located on the shaft by a ground pilot. Propeller end of the shaft is No. O S.A.E. tapered. Propeller hub for wood propeller is furnished with the engine. A special nut acts as a hub puller.

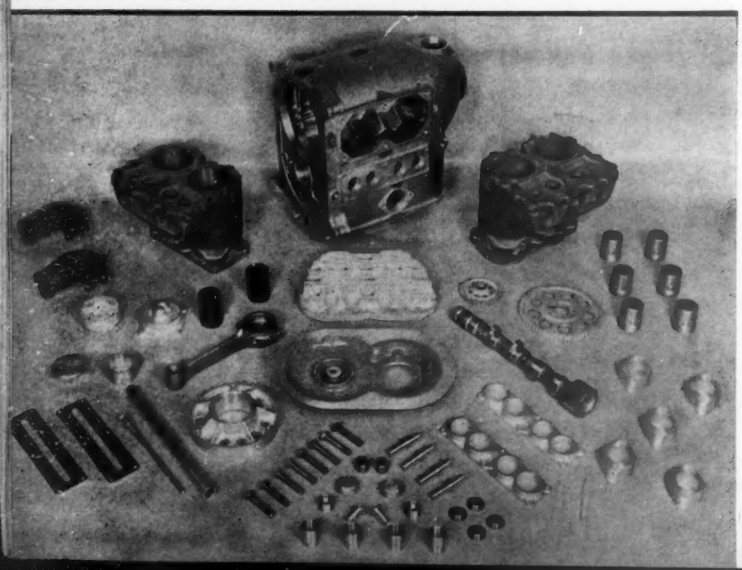
Two-piece connecting rods are of forged steel with a bronze bushing in the small end and copper lead bearings 1⅞ in. diameter by 1 1/16 in. length at the crank throw. Pistons are of cast aluminum alloy with full skirt. Three compression rings and one oil ring are located above the wrist pin. The steel wrist pin is full floating in both piston and connecting rod bushing, being located in the cylinder by aluminum buttons pressed into the pin.

The single camshaft operates all valve followers, being driven at one-half crankshaft speed. Only gears in the engine in addition to the two camshaft drive gears are the oil pump gears. The oil pump is mounted at the front of the case and drives directly off the camshaft front end by means of a tongue and groove coupling.

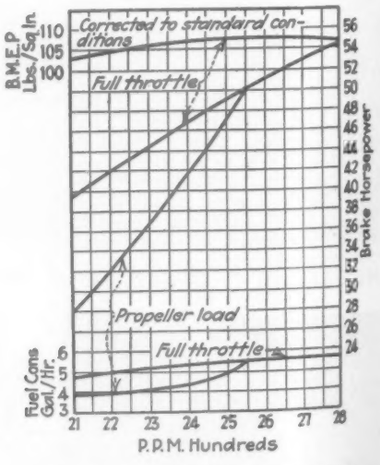
Each bank of two cylinders is separately cast of nickle iron. Valve ports are spaced to permit ample air flow between the ports and the cylinder. Exhaust ports are arranged to direct exhaust gases out beneath the fuselage, and each is equipped with a special finned aluminum cooling flange. Each cylinder block is held to the crankcase by means of six studs and nuts, with a thin paper gasket at the cylinder base joint. Cast aluminum heads attach to the cylinder blocks by means of twenty-two studs and nuts, with Steelbestos gasket between the head and block.

Valves are seated directly in the nickel iron cylinder block. The exhaust valve is of special heat resisting steel. Intake valve diameter is 1½ in. and exhaust valve 1¼ in. Valves are operated by simple followers or tappets located in the case with hardened steel radius ends contacting the cam lobes. An adjustment is provided in

(*Turn to page* 70)



Simplicity of design is characteristic throughout the M-50.



Power curve Menasco Model M-50

Flying Equipment

The Birdmen's Perch

We've got a new one: Let's have cartoon ideas—any and all that may be lurking under your flying bonnets. If they are original and funny, we'll have our artist illustrate them; then we'll publish them and forward the original drawing to the contributor as a present. Like the idea? Okay . . . forward them quick, to:

MAJOR AL WILLIAMS, alias "Tattered Wing-Tips," Mgr., Gulf Aviation Dept., Gulf Aviation Products, Gulf Bldg., Pittsburgh, Pa.

AND WHAT DOES THE LEXINGTON SAY . . . ?

Dear Major: I had just left the naval station at North Island, and the Cyclone in my Curtiss Hawk was turning up nearly full gun when there was just a perceptible shudder in the plane, followed instantly by total obscurity of the windshield. After a semi-blind landing on the carrier, the mechanics had to soak the glass with water in order to remove the splotchy red-and-gray mess which contained just enough ground feathers to identify it as the mortal remains of a medium-dark sea gull. **—L. G. Domning, U.S.S. Saratoga**

REMEMBER THE CASTOR OIL DAYS?

Remember when castor oil was the *only* oil that would stand up in the engine of a crate? But remember, too, the flint-like carbon and pistons cemented tight as soon as the engine cooled?

Such an oil simply wouldn't do today.

For modern flying makes far more severe demands on oils—demands that can be met only by the very finest 100% Pennsylvania oils, refined by every bit of ingenuity available to modern science.

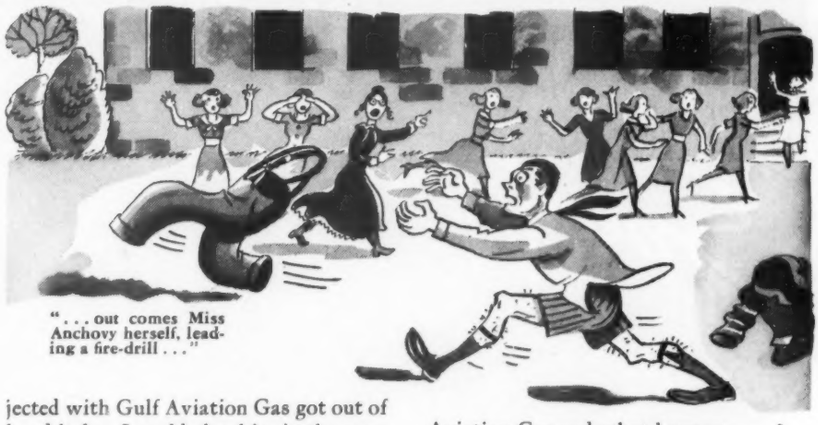
That's what makes Gulfpride Oil—refined by Gulf's patented Alchlor Process—the world's finest oil for planes. This process takes the finest Pennsylvania oil, *already* refined by ordinary methods, and still further refines it—removing as much as 20% *more* black sludge and waste.

HELP!

Can some reader help solve this puzzle?

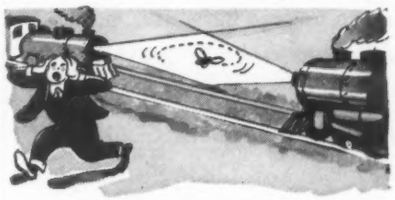
In selecting a gasoline to get the most performance out of my 5 house-fly power plant, I have been injecting selected horse-flies with doses of fuel, and then clocking their time around a circular glass tube.

To avoid unwarranted ridicule, I have been testing them at night near Flyspeck, Wash., close by the railroad track. Several nights ago one of my specimens injected with Gulf Aviation Gas got out of hand before I could clap him in the race-track, and flew out into the path of the Bluebottle Flyer, crack night train.



"... out comes Miss Anchovy herself, leading a fire-drill ..."

I discovered later that at this very moment at Blowfly Junction 150 miles away, the 25-mile-an-hour night freight was switched on the same track as the 75-mile-an-hour Flyer. After these two trains had collided head-on, the remains of my buzzing guinea-pig, still smelling of Gulf Gasoline, was found in the smashed headlights. It was supposed that he had flown back and forth from headlight to head-



light, turning instantly, until the crash.

If he averaged 200 miles an hour, like the other specimens tested with Gulf, how far did the little fly fly? **—L. G. D.**

THIS MONTH'S WHOPPER

Major, two years ago I lose a good pair of pants on account of your gasoline.

These pants are a very important part of a new suit I am wearing at the time, on a hop up-state where I expect to favorably impress a certain candy cane who is at that time an inmate of Miss Aggie P. Anchovy's Select School For Young Ladies. So when I land in their yard, I am very sad indeed that I find a greasespot.

Major, I swab that spot off with Gulf Aviation Gas and what happens . . . ?

That gas hits them pants and a shudder runs through them. They wiggle out from under me, and before I can tackle 'em they've kicked me twice in the shins and are galloping off across the campus hell-bent-for-thursday, me after them. And just as they pass the dormitories, out comes Miss Anchovy herself, leading a fire-drill.

Now Major, I never am not much of a one for admiring myself in the mirror when I get up in the morning. But when that bunch of young ladies lamps me in shorts and garters and turns around, fire or no fire, and marches back in that building . . . well, I just kiss pants good-by, and take off for parts away from there.

I never do see those pants again Major, until years later. Then one stormy night my door-bell jingles. I look out, and there, kind of tattered and sheepish-looking is that old pair of pants of mine. Standing right behind them is a long pair of lady's red-flannel woolies—and bless my soul if, clustered around them aren't six of the cutest little pairs of baby pantalettes you ever did lay your eyes on.

That's *some* gasoline, Major. **—F. A. Z.**

Gulf Oil Corporation and Gulf Refining Company . . . makers of

GULF **GULF AVIATION PRODUCTS**

BUY ACCO QUALITY

● In ships like the one pictured here there is upwards of 100 miles of wire in the control cables. If it is *Hazard* Aircraft Cable (either tinned or galvanized, or the 18/8 stainless steel "KORŌDLESS")—*every foot* of that wire is drawn with meticulous care. We hold our diameter tolerance, for instance, to 5/10,000ths of an inch! Tensile strength requirements are equally rigid. Small wonder airmen everywhere are more and more depending on the uniform, consistent dependability of Hazard cables.

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FORD CHAIN BLOCK DIVISION
Chain Hoists • Trolleys

HAZARD WIRE ROPE DIVISION
Lay-Set Preformed Wire Rope • "Korōdless" Wire Rope • Preformed Spring-Lay Wire Rope • Guard Rail Cable

HIGHLAND IRON & STEEL DIVISION
Wrought Iron Bars and Shapes

MANLEY MANUFACTURING DIVISION
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OWEN SILENT SPRING COMPANY, Inc.
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Page Fence • Wire and Rod Products
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READING STEEL CASTING DIVISION
Electric Steel Castings, Rough or Machined
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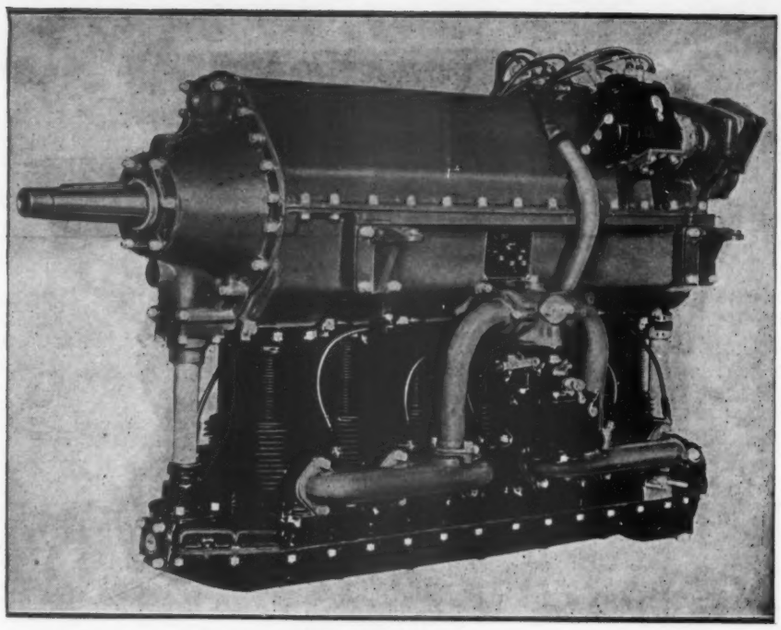
Chain Hoists • Electric Hoists and Cranes

In Business for Your Safety

HAZARD *Aircraft* **CABLE**

Flying Equipment



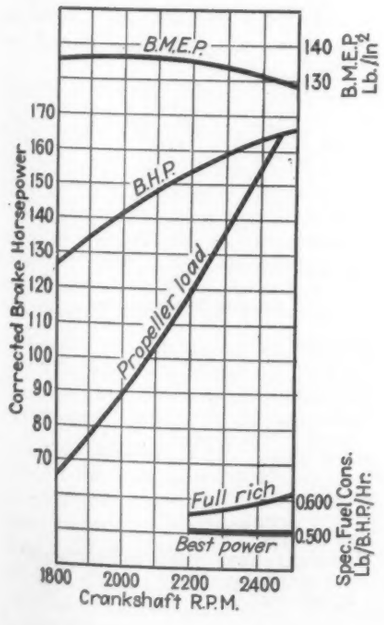
RANGER 6-410-B

A.T.C. issued on new 165 hp. in-line six

A NEW Approved Type Certificate (187) has been awarded the Ranger Engineering Corporation, rating the current production 6-cylinder engine at 165 horsepower. This new model, designated as the 6–410B series, is the latest development of the original Ranger 6–390 model.

Since, to a major extent, parts on all Ranger engines are interchangeable, it has been possible to incorporate many of the refinements which were part of the high-power twelve-cylinder development in the latest six-cylinder engine. In addition, the cylinder bore of the new engine has been increased from 4 in. to 4⅛ in., increasing the displacement from 386.4 to 412 cu. in.

The induction system has been modified by the use of 30 deg. intake valves and the new Stromberg NA–R4B carburetor. The compression ratio was raised from 6 to 6½ to 1 and the engine rated on 80 octane fuel. Improvements have been made in the valve gear, the most important of which has been the change in the type of valve-rocker adjusting screw.



The solid spherical-end screw has been replaced by a two-piece screw with a flat-face half-ball and a spherical socket. Tests and service experience have proved that this new tappet will eliminate valve tip pitting and greatly reduce wear at this point and on the rocker shaft bearings. Valve tappets will maintain proper clearance over long periods of operation without any inspection or adjustment.

The entire engine, including all parts of the valve operating mechanism, has positive automatic lubrication without the use of any external pressure oil pipes or connections. The lubrication system is equipped with effective built-in oil-filtering centrifugal oil-cleaning devices. No parts and no accessories, except generator, require hand lubrication, all operating parts being fully enclosed, and all accessories being of the self-lubricated type.

The 6—410B is equipped with two Bendix SB6R shielded magnetos. This unit has pivotless type contact breakers and sealed grease-packed ball bearings. The magnetos require no lubrication between major overhauls.

In the small airplane, powered by an engine which may be operated full throttle at sea level, the take-off performance of the airplane is largely affected by the form of the Brake Mean Effective Pressure curve for the engine. This is particularly true in installations using fixed pitch propellers.

To obtain the best possible take-off performance, it is desirable to have the take-off r.p.m. coincide with the r.p.m. for maximum B.M.E.P. The actual drop in r.p.m. from rated to take-off conditions with any fixed propeller is governed by the difference in B.M.E.P. between rated and take-off r.p.m.'s. The larger this difference, the less the drop in engine speed during take-off.

One means of obtaining the optimum take-off power is by keeping the valve overlap relatively small, giving improved volumetric efficiency at the lower r.p.m.'s. This condition has been achieved in the new Ranger 6–410 engine. With 13 deg. overlap, the B.M.E.P. has been brought up to 136 lb. per sq. in. at take-off r.p.m., and the horsepower at take-off raised to 145 hp with a rated maximum of 165 hp. The result is a marked improvement in both take-off and climb performance over that obtained with earlier models which provided a take-off B.M.E.P. of only 125 lb. per sq. in.

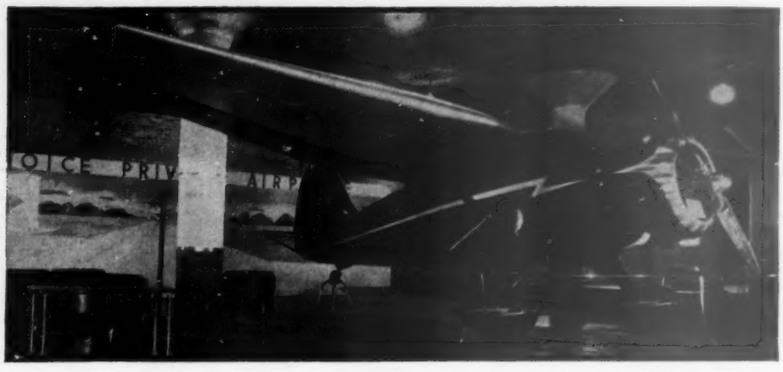
The accessory drive on the 6–410B

(*Continued from page* 41)

is the same type as used on the high-output models. The drive is taken from front end of the crankshaft at a point of minimum torsional vibration and transmitted through a single tubular shaft to accessory drive gears at the rear, the natural flexibility of this shaft eliminating the transmission of vibration and shock loads to the accessory or their driving gears.

The engine is equipped with standard drives and mount pads for starter, generator, fuel pump, and tachometers.

A.T.C. No.	187
Bore	4⅛ in.
Stroke	5⅛ in.
Displacement	411 cu. in.
Compression ratio	6.5 to 1
Fuel	80 Octane
Rated sea level performance	Full Throttle
Brake Horsepower	165
r.p.m.	2450
Recommended Cruising Limits	
Brake Horsepower	125
r.p.m.	2250
Dry Weight (with standard equipment)	350 lb.



STINSON SR9-A

A new Reliant invades the medium priced field

PRICED AT $7485.00 at Wayne, Michigan, to compete with smaller two and three passenger planes, the four passenger Model SR9–A Stinson was shown publicly for the first time at the Chicago Air Show. The Model A is a full sized Reliant powered with the 225 HP Lycoming Motor, which drives a Hamilton metal adjustable propeller. The motor is equipped with automatic valve lubrication, which enables the engine to be flown 14,000 miles between checks.

Standard equipment of the Model A Reliant conforms to those features commonly associated with Reliants in the past and includes: electric starter; hydraulic brakes; trailing edge vacuum flaps; rounded safety glass windshield and cabin windows also of safety glass; wide, full cantilever landing gear with springdraulic shock absorbers; all metal internal construction in wings and fuselage; full NACA Cowling, wheel pants and full fairing throughout.

External finish is up to customary Stinson standards. The fuselage is dark blue, highly polished, with a contrasting silver stripe. The gulled wings are trimmed in a design dominated by silver with a dark blue contrast.

The cabin is designed to give plenty of room for four persons. In fact, the rear seat is the same width found in many cars where three persons are carried in the rear seat. Both front pilot seats may be adjusted fore and aft and the seat backs may be set at different reclining angles. Upholstery is cloth throughout. Controlled ventilation and cabin heater, assist cords, dome light and ash trays are provided. Dual controls are standard equipment, as are navigation lights, tool kit and license numbers. Instruments are mounted in a shock proof indirectly lighted panel and include Kollsman air speed, compass, altimeter, tachometer, oil pressure and temperature gauges.

Franklin AC-150

(*Continued from page* 34)

is forged as an integral part of the shaft.

Another innovation of this Franklin AC-150 engine is the use of "Celeron" timing gears. It was found that these gears are definitely more quiet and longerlived.

The oil capacity of the crankcase is four quarts and the maximum consumption of the engine is approximately one ounce of oil per hours when operating at 2400 r.p.m. under full throttle operation.

The alloy steel connecting rods are of conventional design with a bronze bushing pressed in the upper end for the piston and lubricated by splash within the engine case. The big end bearing is of the replaceable thin steel filled type with a copper lead lining.

Pistons are Ray Day designed and cast of aluminum alloy. The piston pins are full floating and are restrained by an alloy steel spring at each end. The piston carries Perfect Circle ⅛ inch, Type 200 rings in the top groove, a Simplex ⅛ inch molium ring in the next groove. The pistons are fitted with .0075 inch clearance,

Carburetion is by a Stromberg NA-S2 up-draft carburetor with 1/18 inch venturi and No. 52 main jet. Aluminum intake pipes connect the manifold separately to all four intake ports.

The Franklin AC-150 engine is regularly supplied with single Scintilla magneto with single plugs. It is also available with dual magnetos, or with single Scintilla and Auto-Lite generators, or with dual Auto-Lite ignition.

A self-contained cooling system can also be supplied for this engine,—or it can be cooled from the propeller. The self-contained system incorporates a centrifugal blower mounted on the crankshaft and suitable housings for conducting air to each cylinder in correct proportions.

General Specifications

Bore: 3⅝"
Stroke: 3⅝"
Displacement: 150 cu.in.
Compression ratio: 6.5: 1
Fuel: Gasoline 70 octane, 73 octane or better recommended.
Power Rating: 50 hp. at 2400 r.p.m.
Weight: 154 lb., single ignition.
Width overall: 34⅜"
Length overall: 27½"
Height: 18⅜"
Mounting: Four supports integral with the crankcase, 10 in. across, 10¼ in. lengthwise.

KLM

ROYAL DUTCH AIR LINES

Super-Speed LOCKHEED 14 Powered by WRIGHT CYCLONES

Super-speed Lockheed 14 transports, powered by Wright Cyclones, are now being delivered to K.L.M. (Royal Dutch Air Lines) for its European and West Indies-South American operations—and to K.N.I.L.M. (Royal Netherlands Indies Airways) for use in the Dutch East Indies.

The new Cyclone-powered Lockheed 14 has a high speed of 260 m.p.h. These swift airliners will provide Europe's fastest air transportation. They will be used on K.L.M. routes which spread in all directions from Amsterdam serving London, Paris, Berlin, Vienna and many other important cities of Europe.

K.L.M. will also use Lockheed 14 transports on its major service between the West Indies and South America—extending from the island of Barbados to Trinidad and on to La Guaira, Curacao, Aruba, and Maracaibo, Venezuela.

K.L.M. (Royal Dutch Air Lines) and its associate company K.N.I.L.M. (Royal Netherlands Indies Airways) is the world's pioneer airline system—extending from Amsterdâm, Holland to Batavia, Java—a distance of 9000 miles.

Wright Cyclones power all of K.L.M.'s great fleets of Douglas DC-2 and DC-3 airliners. These giant planes fly from Amsterdam, Holland to Batavia, Java in 5½ days—compared with 3 weeks by the fastest rail-water travel. K.L.M. recently completed, with a Cyclone-powered Douglas DC-3, its 500th round trip to the Far East.

The first of the new Cyclone-Powered Lockheed 14's delivered to K-L-M [Royal Dutch Air Lines].

WRIGHT
AERONAUTICAL CORPORATION
PATERSON NEW JERSEY
A DIVISION OF CURTISS-WRIGHT CORPORATION

Aircraft Radio

New Equipment for Communication and Navigation by Henney and Fink

United "hoop-loop"

New device tested on ground stations

ENCOURAGED by the success of their static-elimination program in connection with their planes, United Airlines have developed an electrostatically-shielded loop of large dimensions, to be used in ground stations. The loop, about 5 feet in diameter and of thin section, closely resembles a large hoop. The metallic tube, which surrounds the loop wires, prevents the electrostatic component of the incoming wave from affecting the receiver. The magnetic component, on the other hand, is received due to the presence of an insulation segment in the tube. Since static is primarily an electrostatic effect, the loop discriminates against static in favor of the signal The success of this principal in flight, in the special type of "snow" static encountered in the upper air, depends upon the strength of the static. Its effectiveness against ground static (snow static is rarely encountered on ground stations) is now the subject of study by United engineers.

RING AROUND A ROSIE Hoop-loop now being tested by United as anti-static antenna for ground stations.

Radio Navimeter

Navigating calculator for radio direction-finders

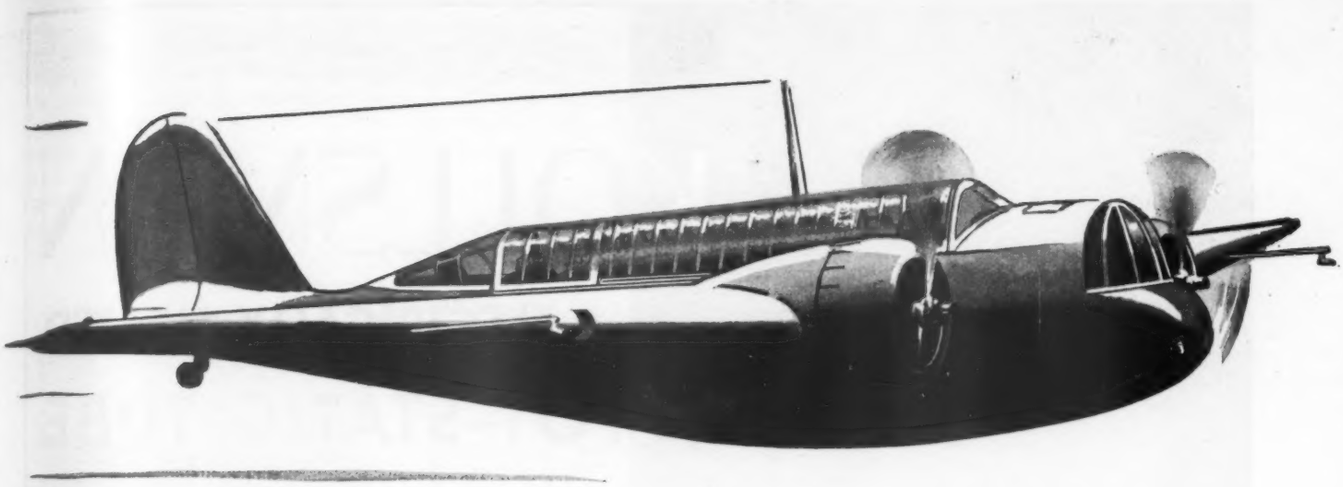
THE L.M.T. LABORATORIES of Paris, a subsidiary of the International Telephone and Telegraph Company, have designed a compact calculating instrument, called "Radio-Navimeter", which can be used for translating the indicated bearings of any navigation instrument (magnetic compass, gyro compass, or radio direction-finder) into the bearings relative to true geographical north or magnetic north. The device contains a cam mechanism which automatically introduces the required compensation for the quadrantal error of the radio-compass.

One side of the calculator contains three separately-rotatable compass cards, one for geographical bearings, one for magnetic bearings, and one for radio-compass bearings, the latter being compensated. Two arms, rotatable about the center, are used for lining up the three compass cards according to the requirements of the problem. On the reverse side of the calculator is a small circular slide-rule, and tables of angular values needed for computing ground speeds and distances traveled. The instrument measures about 6 inches in diameter, and weighs about 10 ounces. The quadrantal error cam is cut according to the requirements of the installation with which the calculator is to be used. If the error curve is known, the pilot may cut the cam himself.

D of C Radio Report

Jackson Reviews Instrument Landing

ALL PILOTS AND AIRCRAFT RADIO ENGINEERS interested in the instrument-landing problem should obtain a copy of "Report on the Status of Instrument Landing Systems", written by W. E. Jackson, Chief of the Radio Development Section of the Bureau of Air Commerce, published by the Department of Commerce. The history and present state of the art are completely and fairly treated, from the earliest Bureau of Standards work in 1919, to the 1937 recommendations of



New MARTIN 166 BOMBER

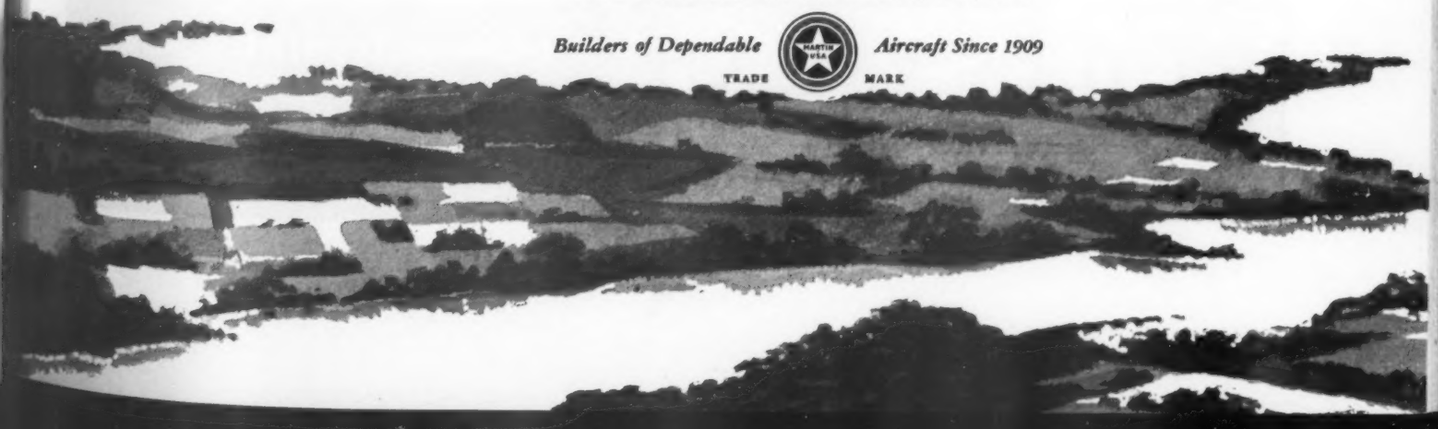
NOW—the Greatest in a long line of famous military aircraft—the new Model 166 Martin Bomber . . . It is a Great Ship: Greater Speed, Greater Range, Greater Striking Power. This newest Martin Bomber has back of it the heritage of twenty years of experience in the development of bombardment aircraft for national defense the world over. Aerodynamic improvements and structural refinements give the Model 166 striking power undreamed of but a few short years ago . . . This new ship is available for export. We will be glad to quote delivery dates to interested governments.

THE GLENN L. **MARTIN** COMPANY

BALTIMORE, MARYLAND, U. S. A.

Builders of Dependable *Aircraft Since 1909*

TRADE MARK



KOLLSMAN

ELECTRICALLY HEATED PITOT-STATIC TUBE

ICE will not form on the critical surfaces of the Kollsman Electrically Heated Pitot-Static Tube —assuring continuous accurate operation of the Air Speed Indicator, Altimeter and Vertical Speed Indicator under all flight conditions.

The design of the Kollsman Pitot-Static Tube —mechanical, aerodynamic and thermal—is based upon exhaustive wind-tunnel and flight tests. All elements are enclosed in a one-piece copper shell of correct aerodynamic form. The heating element is hermetically sealed within the shell. The tube itself is rain-proof and self-draining, both on the ground and in flight, and no amount of water can put it out of action.

Electric supply is automatically regulated, giving maximum heat at low temperatures, yet so reducing the current at high temperatures that it is impossible to burn out the heater. The electrical connections are permanently welded.

The Kollsman Electrically Heated Pitot-Static Tube, Type 172B, is for mounting, as shown, at the lower end of a vertical streamline tube. Two other types are available—Type 369, for the forward end of a horizontal round tube, and Type 359, for the upper end of a vertical streamline tube above wing or fuselage.

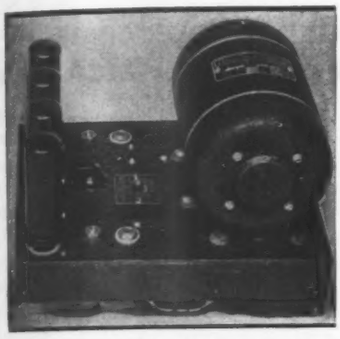
Specifications and more detailed information will gladly be supplied on request.

KOLLSMAN

PRECISION AIRCRAFT INSTRUMENTS

KOLLSMAN INSTRUMENT COMPANY
INCORPORATED
8008 FORTY-FIFTH AVE., ELMHURST, N. Y.
WESTERN BRANCH: GRAND CENTRAL AIR TERMINAL, GLENDALE, CAL.

the airlines. The report is 31 pages long, and though it is not illustrated, the author manages to make clear the methods used by the Bureau, by the Army, by Lorentz, by Bendix, United Airlines, TWA, and Washington Institute of Technology. An excellent list of references closes the report. It is highly recommended.



Air Radio, Model AR-30-W transmitter

Two New Transmitters

The "Shreve-Aero" and the AR-30-W for private flyer

AIR RADIO, of the Chicago Municipal Airport, at 5214 W. 63rd Street, Chicago, announces a new transmitter, Model AR-30-W, intended for private aircraft. The entire transmitter and power dynamotor are mounted on one chassis, eliminating the need of extra power cables. Fixed, locked tuning is employed, crystal controlled, with the standard 3105 kc. itinerant frequency. Any other frequency between 2000 and 6500 kc. can be supplied. The output is thirty watts, 100 per cent modulated. Four type 6L6 tubes are used. The unit contains a volume control for adjusting the volume of side tone supplied from the microphone to the headphones. The price, installed in the plane, including a trailing-wire antenna, is $250.

The Radio Laboratory of the Park Hill Airport at Denver, Colorado, announces a 3-tube light-weight "Shreve-Aero" transmitter for the private flyer, capable of delivering 15 or 35 watts, depending on the power supply used. The three-frequency type (3105, 3120, and 6210 kc.) measures 9¼" by 8¾" by 7⅞", and weighs 22 pounds. The price range is from $342.30 to $457.45 depending on the number of crystal frequencies included. The dynamotor power supplies are mounted integral with the transmitter. Antenna reels, and other antenna accessories aircraft microphone, and ignition filters, etc., can be supplied by the same company. The transmitter installation includues a side-tone panel and interphone system.

22-lb. Transmitter

Western Electric Exhibits Midget at Chicago

A NEW LIGHT-WEIGHT TRANSMITTER, exhibited for the first time at the Chicago Show, has been announced by Western Electric. The new model, designated as model 25A, weighs but 22 pounds including power unit, and measures 7⅛" by 5" by 4¾". Two 6L6 tubes are employed, delivering 15 watts, crystal-controlled, to a properly matched antenna. The transmitter is intended for operation on the itinerant frequencies of 3,105, 3,120, and 6,210 kc. but any frequency between 2,800 and 6,400 kc. is available for use, including the 42 airline frequencies.

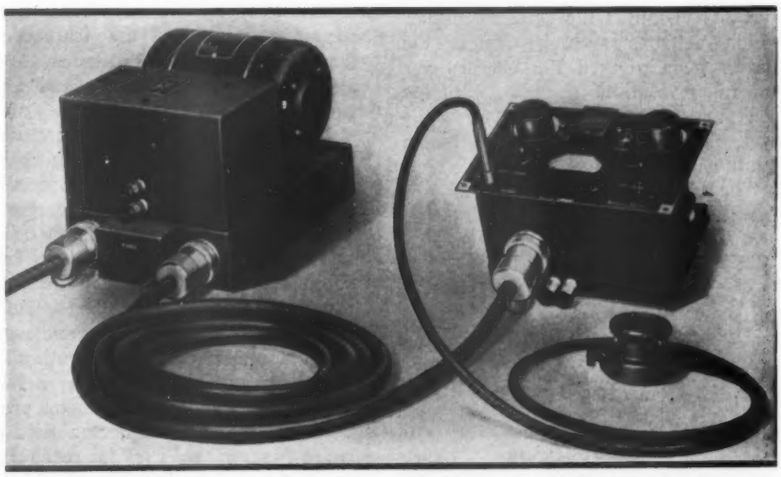
A relay incorporated in the transmitter permits the same antenna to be used both for transmission and reception. The relay is controlled by a push-button attached to the microphone, which the operator "pushes-to-talk". All necessary cables are supplied with the unit.

Other new Western Electric aircraft radio equipment includes a larger transmitter, the type 13CA, which covers both long and short waves, 330 to 500 kc. as well as 1,500 to 7,200 kc. The lower frequency band is useful in communicating with marine and coastal stations. The output, 50 watts, can be fed to a 200-foot trailing antenna, even at the lowest frequency,

Roscoe Turner at the Chicago Show shows the boys and girls how the Bendix streamlined homing-type loop is mounted on the fuselage. Under his arm he carries the receiver, which translates the bearing between incoming wave and the line of flight into a reading on the visual direction indicator

use being made of a special loading coil for this purpose. The total weight, including loading coil is 49 lb. and 9 oz. The crystal maintains frequency control to within 0.025 per cent of the operating frequency, throughout the temperature range from —20 to +60 degrees Centigrade.

A band-pass filter, designed for use in connection with the simultaneous radio range and weather broadcasts from the Bureau of Air Commerce stations, has also been made available by Western. A three-position switch may be connected to the filter to provide both range and voice, range alone, or voice alone.



Western Electric 25A transmitter, 15 watts from 22 pounds.

Buyers' Log Book

What's New in Accessories, Materials, Supplies, and Equipment

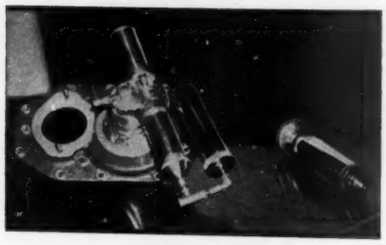
Criley Starter

An interesting new gadget for the light plane owner

HAVING THE DISTINCTION of being the first approved type starter for light aircraft, the Criley hydro-gas engine starter has already met with favor among many operators of Piper Cubs, Taylorcraft, and other light planes. Although purely a manually operated starter in principle, being actuated by the pilot through the medium of air pressure and oil, the Criley starter is a practical cockpit installation which should prove invaluable to operators of light seaplanes, and which eliminates any necessity of climbing out of the cockpit to start the engine on any light plane. This is not only a feature of convenience, but also a marked safety factor.

Manufactured by the Criley Aircraft Industries of Downey, Calif., the Criley starter generates power to turn the engine over from energy stored in an air pressure chamber through hydraulic action. Initial energy is applied by means of a piston actuated by a depressing screw turned by hand (by means of a crank) on the instrument board, or adjacent to it. When the piston has been depressed, a lever is tripped and the stored energy is released against a movable piston in the starter cylinder which actuates a rack against the starter gear to turn the engine over one full revolution. In case the engine does not start on the first turn this cycle may be repeated in less than a minute.

The Criley starter is not only of relatively low price, but it is of extremely low weight, only 4.9 lbs. complete. Also, most of the parts are of standard automotive manufacture, of low cost and readily obtainable for replacement. Since the air pressure energy stored for operation of the starting cycle reaches a pressure of approximately 700 lb. per sq. in. the starting action is much more vigorous than is possible in pulling the propeller through by hand, and it is claimed that this rapid turn-over produces relatively quick starts. In the event of a back-fire the starter merely recharges itself automatically and is ready to be tripped again without the necessity of hand charging.—AVIATION, *March, 1938.*



Criley Starter

Do-All Contour Machine

A filing machine for the small shop

A NEW LOW PRICED MODEL of the Do-all contour machine has just been placed on the market by Continental Machine Specialties, Inc., Minneapolis. It is designated as the V16, due to its new 16" throat capacity and two ranges of infinitely variable speed. This new model is styled on the lines of the company's Metalmaster. It incorporates many of the features of the larger machine, such as, automatic butt welder built-in, and four-way table tilt.

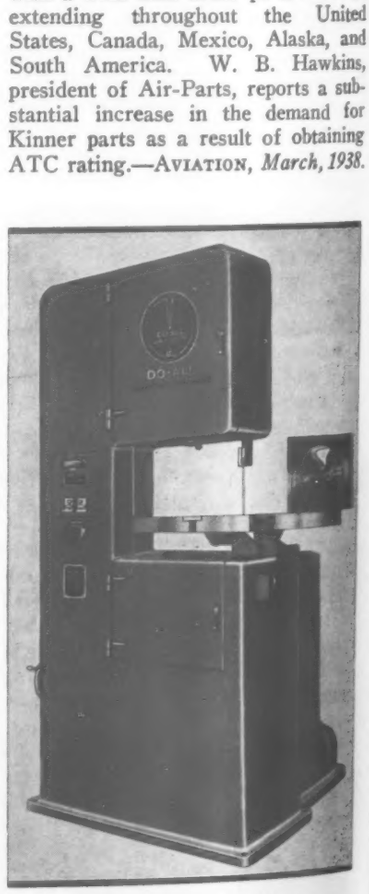
It is of heavy welded steel construction. When filing, the machine has a new two-piece file backing member, which makes it unnecessary to remove anything for internal filing operation.

The lower range of speed is from 75 to 450 ft. per minute. The upper range is from 450 to 2,800 ft. per minute. Thus, shops may handle production sheet metal fabricating on this new machine tool, as well as Do-all tool room work. As on previous models, a Job Selector tells the correct speed to use for each job, whether sawing, filing or polishing.—AVIATION, *March, 1938.*

Kinner Replacements

Air-Parts Secures ATC on parts

UNIQUE IN THE FIELD of supplying engine replacement parts is the action of Air-Parts, Inc., Glendale, Calif., in fitting a standard Kinner K-5 engine with a number of special replacement parts and running an official ATC fifty hour test under B of AC supervision. Among replacement parts approved as a result of this run, but manufactured by Air-Parts, Inc., instead of the original manufacturer, are pistons, valves, nose section, cylinder heads, cam follower guides, valve guides, etc. Air-Parts, Inc., operates its own machine shop in connection with a wide mail order parts business extending throughout the United States, Canada, Mexico, Alaska, and South America. W. B. Hawkins, president of Air-Parts, reports a substantial increase in the demand for Kinner parts as a result of obtaining ATC rating.—AVIATION, *March, 1938.*



Do-All Contour Machine

Brazing Alloy

Developed for use at unusually low temperatures

BECAUSE IT PERMITS BRAZING at unusually low temperatures, avoiding damage to structure of the metals being joined, the new Easy Flo Brazing Alloy introduced by Handy & Harman, (82 Fulton St., New York), is of special interest to the aviation industry. Easy Flo flows freely at 1175 deg. F. and works equally well on both ferrous and non-ferrous metals. It is being widely used for joining stainless steel, monel metal, and many chrome nickel and copper-nickel alloys. It is also useful in joining dissimilar metals at low temperature.—AVIATION, *March, 1938.*

"Grabit" Boat Hook

A handy accessory for seaplane owners

A NEW INVENTION which has a distinct place in sea plane equipment, has recently been placed on the market by the Thomas Laughlin Co., manufacturers of marine and industrial hardware, of Portland, Maine. This item is known as the "Grabit" Boat Hook and is of greatest assistance in securing planes to mooring ring. A light line is spliced into the eye of the boat hook and the other end made fast on the plane. When the hook engages the ring, it is locked in place by the tongue, shown in the illustration. The boat hook handle detaches itself from the hook and thus the plane is quickly moored.

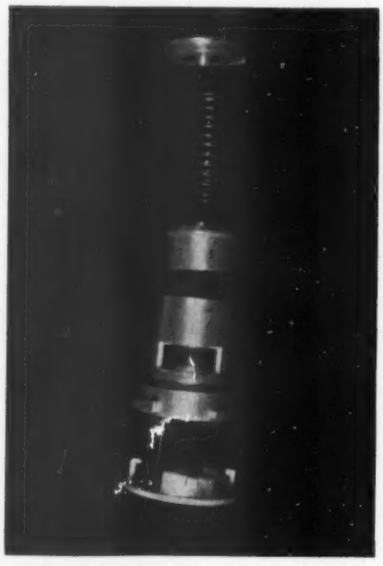
The "Grabit" Boat Hook has been approved by the British Air Ministry. Its application to aviation was developed by Mr. Olcott S. Payson, of the Thomas Laughlin Co., a licensed pilot of many years standing, formerly associated with Skyways, Inc., of Boston, Mass.—AVIATION, *March, 1938.*

"Grabit" Boat Hook

Fills Tanks From Bottom

Valve unit developed by Thos. L. Siebenthaler

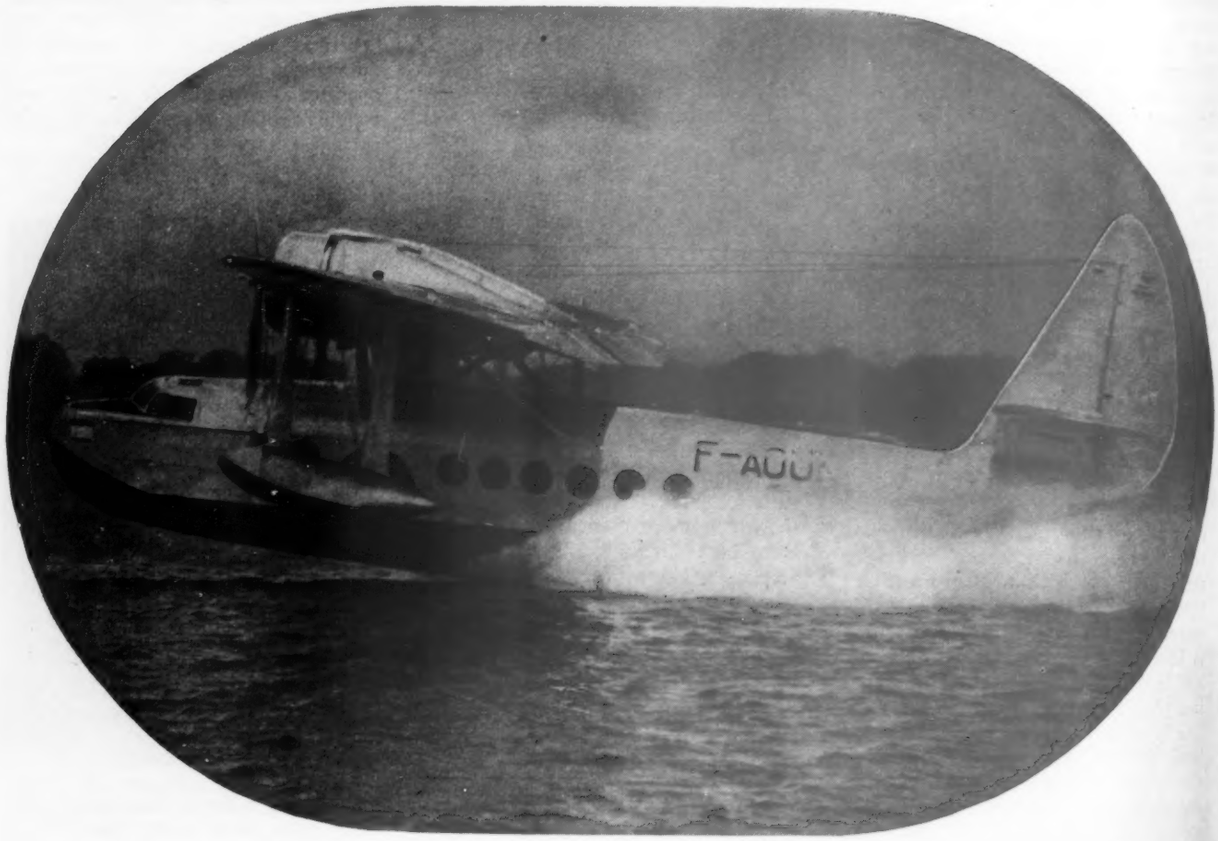
DEVELOPED by the Thos L. Siebenthaler Mfg. Co., 410 West Sixth St., Kansas City, Mo., manufacturers of aeronautical supplies, a new valve fills fuel tanks from the bottom instead of the top as at present. What sounds at first like a gag is really seen to be an idea of merit on second thought. Not only do airline attendants waste a great deal of time climbing up on the wings of transport planes to fill the fuel tanks, but they also damage the plane to some extent in thus climbing over it. Moreover, the personnel also suffers damage for insurance records show that more than a score of men were hurt during 1937 in falls from airplane wings while engaged in filling wing fuel tanks. And one of these men was permanently incapacitated by injury. Furthermore, with transport planes growing larger the problem of fueling them will become acute. To offset this problem the SpeeDee valve has been developed under patents of the Fog Nozzle Co. of Los Angeles, Calif. The SpeeDee valve is a leak proof unit in the bottom of the tank. To use it requires a special make-up unit on the end of the fueling hose, as well as a bottom fuel gauge and a special vent. This complete system has been perfected by the Siebenthaler Company and is now being supplied on test to several airline operators. The fuel gauge reading on the under side of the tank is actually leak proof, and shows the operator what quantity of fuel is in the tank being filled, thus speeding up the operation. The special vent is incorporated in the regular top filler cap, thus leaving the regular filler cap for use in filling the tanks at stations where the SpeeDee valve equipment is not used. The SpeeDee valve and make-up unit are for all practical purposes both foolproof and leakproof. Through their use the tank may be filled or drained from the bottom, or the operator may draw off a fuel sample, all without disconnecting the make-up unit from the valve. The SpeeDee valve has been developed in two models to date, one having a capacity of 150 gal. per minute at a fuel hose pressure of 20 lb. per sq.in., and the other a capacity of 250 gal. per min. at a pressure of 40 lb. per sq.in. Due to the use of a special spring and gravity valve in the SpeeDee valve unit it is possible to connect and disconnect the make-up unit without loss of fuel. Heavy rubber tires, or buffers, are mounted on the makeup unit in order to permit the operator to handle it freely, even roughly, without damage to the valve parts.—AVIATION, *March, 1938.*



Internal gravity and spring loaded piston of the SpeeDee valve, shown with valve body, spring, and cap

SpeeDee makeup unit and valve shown coupled

Chargeurs Réunis
Takes Another Sikorsky



LAST year Chargeurs Réunis, famous French steamship line... through its newly-formed subsidiary Aero Maritime... opened a 3,000 mile air service along the west coast of Africa between Dakar and Pointe Noire... selecting for this operation a fleet of three Sikorsky amphibions. These Sikorskys have performed so brilliantly that increasing patronage has required additional equipment... *Another S-43 is now on the way.*

SIKORSKY AIRCRAFT

BRIDGEPORT, CONNECTICUT

ONE OF THE FOUR DIVISIONS OF UNITED AIRCRAFT CORPORATION

THE AVIATION NEWS

REVIEW, COMMENT, FORECAST

DANIEL SAYRE
C. F. McReynolds, *Pacific Coast*
Blaine Stubblefield, *Washington*
E. R. Lockin, *New York*

MARCH 1938

U.S. Industry Breaks All Records

(Story on page 53)

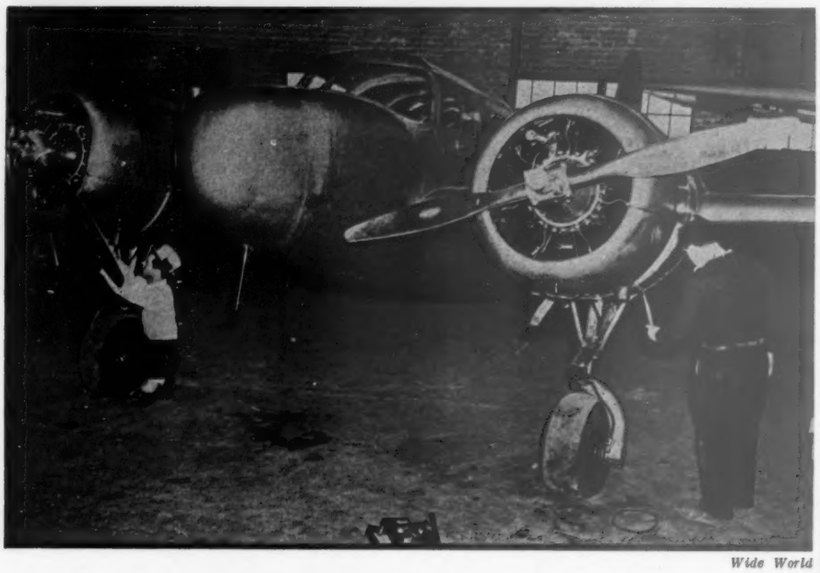
FLYAWAY HARTFORD: Ten Vought Corsairs (P & W Wasps and H. S. props) lined up for a delivery flight to Mexico City. Flown by Mexican Army pilots under the command of Lieut. Col. Rafael Monterro, the flight sets a precedent as the first across the U.S. of an entire squadron destined for a foreign government. Stops were made at Washington, Cincinnati, Nashville, Shreveport, San Antonio, Laredo (Mex.) and Mexico City. The ships are specially designed for high altitude operations.

Wide World

ONE CENT A YEAR: Carroll Cone, manager of Pan American's Atlantic Division (left) discusses Pan Am. bid of .00001 cents per pound for a U.S.-Bermuda air mail contract with Harlee Branch (right). P.S.: Pan Am. got the contract. No one else turned in a bid anyway.

A GREATER TEMPELHOF! Germany is rushing a huge program of improvements on its Berlin terminal. Runways will be 5,000 to 7,500 ft. Photo below shows model of magnificent mid-field buildings reached through underground roads and railways. Planes taxi directly under a big overhanging roof to load and unload.

Wide World



Wide World

PLANE PREVIEWS: What with Spring coming on new ships are bursting through hangar doors all over the country. At the top—The brainchild of Otto and Wally Timm rolls out of the Glendale shop for test hopping. Note tricycle gear. A pair of 425 hp. Wright Whirlwinds are in the nacelles.

Immediately above—Frank W. Bennett, Dallas oil man, is backing Vance Breese and Art Mankey in building a twin engined, all wood ship. Two Jacobs engines furnish the power. The scene is Van Nuys (Cal.)

Below—A purely experimental project to check out certain theories of the aerodynamics of tail-less airplanes underway at New Philadelphia, Ohio. Tuscar Metals, Inc., is sponsoring it. Tom Carroll and Tom Huff designed it and Jimmy Taylor recently test flew it at Cleveland. Engine is a Menasco 95 hp.

SPOT LANDINGS

On the Month's News

• **A measure of self protection** for the non-scheduled operator against unfavorable legislation will be the objective of a new organization. Groundwork was laid at a three-day meeting of operators at the Chicago Air Show, at which Leslie E. Neville of AVIATION served as secretary. Until a definite structure can be given the organization at a second meeting, Hugh C. Robbins, Waco distributor for Ohio, and Hal P. Henning, Stinson distributor for Texas, have been named to receive suggestions as to the form and details desired by interested airmen.

• **Did you ever hear of R.E.P.?** Or to give him his full name, Robert Esnault-Pelterie, one of the earliest of French airplane designers. Well one of the things he lays claim to designing is the joystick type of airplane controls. Soon after the War the French government paid him a goodly sum in recognition of that claim. Now after some 20 years of litigation our own Supreme Court has upheld him in a suit against the U. S. government. Damages, not yet settled, may run to as much as $1,000,000.

• **Australia likes our transports** well enough to lift the 20 per cent tariff charges it has so far laid against them. Now sole importing expense on "types unobtainable in Great Britain" will be four per cent for "primage." Instruments and engine parts which have been soaked up to 65 per cent will probably also be admitted on the same basis.

• **Six Flying Fortresses off to S. A.** makes a welcome headline to American exporters fighting against European "pay when you like" aircraft sales policies in Latin America. The appearance of these ships at President Ortiz inauguration should do much to offset recent spectacular prestige-building by Italian, French and German flyers. The American squadron, under Lieut. Col. Olds, chose the West Coast route via Panama, Peru and Chile.

• **Now the first Boeing 314 is out,** or at least outdoors for final assembly and finishing, get set for a year or so of superlatives in airplane descriptions. The 314s are so large they will take a fifteen-ton "floating drydock" and beaching gear to handle them. First flight tests are expected late in April or early in May. About that time should come the Douglas DC-4; a little later the Boeing 307S and 307. About that time the English may shove over in an Ensign. And so it will go.

Aero Chamber Survey Sets '37 Deliveries at $115,000,000

President Rogers puts industry's capacity at twice that figure

THE AERONAUTICAL CHAMBER OF COMMERCE OF AMERICA, INC. made three interesting and newsworthy announcements last month.

First: It had re-elected Leighton W. Rogers as its president for the coming year.

Second: The American aircraft industry has broken all peace time production records during 1937.

Third: A survey conducted by the Chamber showed the production possibilities of our present plants had never been even approached.

We abstract the last two releases below. By chance or design their issue, while Washington is seething with questions over our potential defensive resources, was little short of genius.

Looking Backward

"1937 was a record peacetime year for the aircraft manufacturing industry in the United States and the first in which deliveries passed a hundred million dollars.

"Sales of airplanes, aircraft engines and spare parts totalled $115,076,950 in 1937, an increase of 50 per cent over the 1936 sales of $76,804,818," Mr. Rogers reported. "Commercial airplane deliveries last year amounted to 2,238 valued at $19,230,650, less engines, as compared to 1,528 valued at $12,535,526 in 1936. The increase in the number of planes was most pronounced in the light, two-place machines, a total of 1,542 being delivered last year as against 898 in 1936. The number of planes in the transport class also increased 100 per cent, 188 multi-engine planes being delivered in 1937 as compared to 94 in 1936.

"Military airplane deliveries in 1937 totalled 949 valued at $37,095,528 less engines, as compared to 1,024 military planes valued at $26,898,916 in 1936....

"Commercial aircraft engines delivered in 1937 totalled 4,020 valued at $15,243,571, as compared to 2,527 valued at $7,946,015 in 1936. Military aircraft engines delivered in 1937 totalled 1,994 valued at $14,894,113, as compared to 1,794 engines at $14,619,453 in 1936.

Looking Forward

"American aircraft manufacturers can turn out more than twice the dollar volume of their present record peacetime production of planes, engines and accessories without expanding existing plant facilities," according to a survey of the entire industry made public here yesterday by Leighton W. Rogers. "Production could be stepped up to $345,000,000 during the next fiscal year and still remain on a peacetime basis," the report states.

"The survey indicated that of the total capacity business of $345,000,000 the airplane plants would account for $263,000,000, less engine values, with the balance of $82,000,000 being apportioned among the plants producing engines, instruments and other accessories.

"The capacity of the plants to produce more than 100 per cent of their current output is based on conservative estimates from the manufacturers who appreciate the public interest in knowing the present capabilities of this industry," the Rogers report continues. . . .

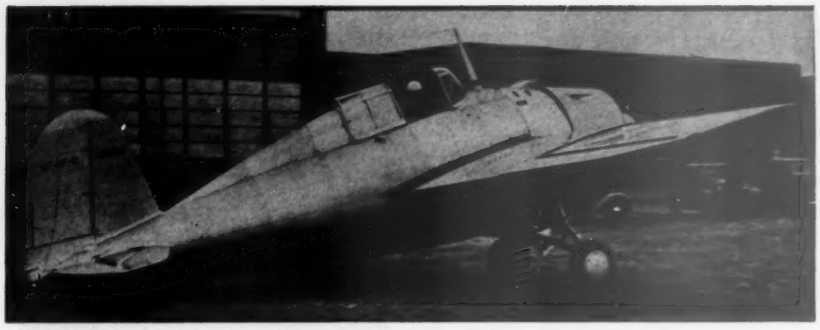
"Their estimates were based on the equipment they are now manufacturing without contemplating new models or types. They did not provide for new factory space or other facilities requiring refinancing.

"Only one kind of expansion is provided for labor. . . . A total of 36,000 men are now employed in current production, whereas the industry could handle the $345,000,000 worth of business during the fiscal year ending June 30, 1939, by employing 38,000 additional men, and operating the plants in three 8-hour shifts daily.

"It is interesting to note that the aircraft manufacturing industry employed not more than 14,000 men in 1934, the number increasing steadily until 36,000 are now employed, while the industry, if working at full capacity, would employ a total of 74,000 men. . . .

LEIGHTON W. ROGERS
Made Three Headlines

HEADS INSTITUTE: T. P. Wright, vice president in charge of Engineering for Curtiss-Wright Corporation, has been elected president of the Institute of the Aeronautical Sciences. Working with Curtiss-Wright or its predecessor companies since 1920 Wright holds an honorary doctorate from Knox College and is known through the entire aeronautical world as a skillful designer and administrator. He succeeds Dr. Clark B. Millikan. His election took place at the Institute's Annual Meeting held during a brilliant four-day technical program at Columbia University. Over 400 attended sessions which lasted four days and covered the entire aeronautical field.



GRUMMAN'S LATEST: An exceedingly interesting mid-wing fighter bomber recently put through flight-tests by Grumman and Navy experts. No performance details have yet been released. Last month the Fort William plant of the Canadian Car and Foundry Company flight-tested a biplane built under license from plans of the Grumman F3F1. A total of 46 are already in production. They are intended for export.

Lockheed Booms Ahead

CURRENT OPERATIONS of Lockheed Aircraft Corporation reached a new record level during January. A $742,000 order from Trans-Canada Airlines for an additional six Model 14 transports brought the Lockheed backlog of unfilled business to a new high mark of $6,572,000, as compared with $5,830,000 on January 1. Total deliveries for the year 1937 were eighty-eight planes representing sales of $4,750,000. In addition to its commercial business Lockheed is making a strong bid for military business. First military plane was the XC-35, a stratosphere version of the Electra which is now successfully demonstrating sub-stratosphere flying in the hands of Army personnel. A modification of the Model 14 is now being tested by the Army for possible use as a cargo plane. The company is bidding for Army orders on a high speed six passenger commercial transport, and will also bid for business with a tactical type craft in the near future. During 1937 the Lockheed Corp. completed a million dollar building program bringing total plant area to 240,000 sq. ft.

Half A Million Profits

NORTH AMERICAN AVIATION, INC., Inglewood, Cal., completed its most successful quarter in the three months ended December 31, 1937. Earnings for the quarter exceeded the figure of $227,055 earned for the full nine months preceding, indicating earnings for the full year in excess of $454,000, as compared with net profits of only $4,230 for the full year 1936. North American's backlog of unfilled orders now approximates $10,500,000 and plant payroll totals more than 2,200 persons.

Cessna Doubles '36 Figures

NET SALES of Cessna Aircraft Co. in 1937 were 112 per cent greater than in 1936. Dwane Wallace, president, stated last month. Sales totaled approximately $300,000, against $141,567 in 1936. Fifty planes were sold during the year, against 34 in 1936.

Mr. Wallace pointed out in the report of sales that the planes were being used in 10 different fields of aviation, including air photography, crop dusting, oil surveys, government weather flying, ambulance service, charter and air taxi service, business executives, sportsmen pilots, freight and express service and flying schools.

To start off the new year right, Cessna has already contracted to deliver 15 Airmasters to Mal Carberry, Pacific Coast distributor. Price involved is placed at $105,000.

Adds New Shops to New Plant

DOUGLAS AIRCRAFT has completed a $310,000 building program under which its plant was enlarged to a total floor area of approximately one million square feet, making it one of the larger refined-product industrial plants in America. The latest additions include a raw stock storage and receiving building measuring 75 by 380 ft., and a new assembly building measuring 200 by 600 ft. Both additions were designed by Architects Edward Cray Taylor and Ellis Wing Taylor. F. W. Conant, Douglas assistant general manager, supervised construction of the units. L. N. Davis, plant engineer, coordinated the work of the several contractors and supervised installation of electrical and mechanical equipment.

Ten Bombers a Month

CONSOLIDATED AIRCRAFT CORPORATION, San Diego, with orders for approximately one hundred Navy flying boats on the books, reported as of Feb 1, that deliveries were averaging ten patrol planes per month, with current business sufficient to maintain the company on a full production schedule for one year. Total unfilled orders as of Feb. 1, stood at approximately $14,000,000 compared with total deliveries during 1937 of about $12,000,000.

Business Is Fine, Martin

GLENN L. MARTIN last month announced his company has a $17,500,000 backlog of unfilled orders, the largest in the company's history, which he said reflected "the progress already made in the company's program of expansion, advanced technical development and increased production.

"The company is entering a period of growth and increased activity in the production of advanced types of aircraft for the world market," he added.

Simultaneously Mr. Martin announced the follcwing promotions had been approved by his Board of Directors: J. T. Hartson to the position of Executive Vice-President; Harry F. Vollmer to the position of Vice-President of Manufacturing; B. C. Boulton to the position of Vice-President of Engineering.

Western Air Refinances

THE BOARD OF DIRECTORS of Western Air Express Corporation have authorized issuance of 130,818 shares of capital stock of the company to stockholders at $2 per share, with present stockholders being given the right to purchase one new share for each two shares of stock now held.

PROFITS AND LOSSES

» ROOSEVELT FIELD, INC., for year ending December 31, 1937, net income $979; for 1936, net loss was $3,262. Capital stock 298,700 shares.

» AIR ASSOCIATES, INC., for quarter ending December 31, 1937, profit, $28,126; same period, 1936, profit $16,912. Company's fiscal year ended September 30. Net profit for the year, $83,390 or 77c. on common stock; for preceding year, net profit, $65,033, or 55c. a share. Net sales for 1937, $1,450,367, compared with $1,045,114 for 1936.

» PENNSYLVANIA-CENTRAL AIRLINES CORP., for nine months ended September 30, 1937, net loss $109,781. Net income, September quarter, $38,146.

» DEHAVILLAND AIRCRAFT CO., for year ended September 30, 1937, net profit £122,184, compared with £71,709 in preceding year.

» IRVING AIR CHUTE CO., and subsidiaries for year ending December 31, 1937, net income $278,643 or $1.40 a share, compared with $208,556 or $1.04 a share for 1936. Sales in 1937, $1,790,075 against $1,345,418 for 1936.

» NATIONAL AVIATION CORPORATION for year ending December 31, 1937, net profit, including $62,128 profit on sale of securities, $131,186; against net profit, including $902,669 profit on sale of securities, of $854,537 in 1936.

AVIATION IN WASHINGTON

by BLAINE STUBBLEFIELD

"Experts" tear up seven versions of Air Commission bill

When President Roosevelt called Senator McCarran and Congressman Lea to his office in January and told them to write a bill setting up a separate civil aeronautics commission, the long legislative row seemed to be nearing an end. But the President then turned the problem over to Son James. Immediately the Post Office and Commerce boys moved in with Jimmy. And together they set about to make aviation the guinea pig for the President's government-reorganzation program. The new Bureau of Aeronautics, they decided, should be the ideal government bureau—a streamlined fashion plate for all the old frumps like the ICC. In about 30 days they re-wrote the independent commission bill six or seven times. As a consequence the prospect for really constructive aeronautical legislation is more remote than it was last summer.

The present law is untenable, says the air transport industry, and observers believe operators will accept partial solution rather than complain and risk getting no relief. Specifically many really would rather go under the well established and stable ICC rather than risk the separate commission which will come out of the grab-bag. . . . Few see hope that some strong man or some group in a position to fight will rise and demand non-political regulation. . . . A few think the War Department may put in a big oar. It wants a sound air policy in the interest of national defense . . . Others believe Congress will drastically curtail the President's reorganization program and that air transport will not be sucked into it . . . Also there is a move by the PO and Commerce to amend the Air Commerce Act, side-stepping the ICC-or-New-Commission plan . . . Almost every one fears conflicting interests will mess things badly enough to prevent any action this session.

A civil aeronautics committee in the Senate to consider and pass on all aviation matters is again being pushed by McCarran and others. McCarran believes that such a committee, with himself as chairman, could put through his legislation program without too many White House thumb marks on it. But the National Aeronautic Association, the "Sacramento Club", Col. Carrol Cone (of Pan American) and others, are already booming Senator McAdoo as chairman.

McCarran vs. McAdoo seems to be the resulting situation. McCarran, as ex-officio agent of the President and of the industry in Congress, already has his hands on one set of legislative controls. Washington thinks he will let the Senate committee project ride temporarily rather than risk letting McAdoo freeze onto the set of duals that would be rigged up for the charmian of any such committee.

Special committees become lobbies inside of Congress, say those opposed to the project under any circumstances. They are always packed in favor of the interests they represent, and therefore cannot render fair decisions for the public weal. Members are all pros and no cons. The committee could upset the industry, too, they say. For instance it could favor private flying against air transport or vice versa by culling the President's nominees to the commission. Majority opinion: there will be no Senate committee just yet.

Finagling more airlines for the home folks has been keeping a lot of congressmen busy recently. A Senate bill recommends about a half-million dollars for six new routes from hither to yon. Chances are it will go over all right. If so, the move will dampen the need-for-expansion argument for the convenience-and-necessity certificate system—to some extent. It's a point for the Post Office.

Control of overseas flying by the Maritime Commission is sleeping but not dead. Provision for subsidy and regulation is still in House and Senate bills. Probably the Senate committee, at least, will report the bill as is. Opinion is that Maritime regulation is probably out, but the subsidy might eventually be authorized. Dirigible interests will bring that up at the right time. The right time will be when Germany's helium-inflated ships win back public confidence in transatlantic service.

Air mail week, reminiscent of bygone mail promotion days, will begin May 15, sponsored by the Post Office. Increase the volume, step up frequency, and eliminate the margin between postal receipts and costs, is the objective. Present tentative plans, by hard-working Charles Graddick, are for all 46,000 postmasters to help. The Post Office will go slow on feeder services; perfect the trunk system first.

Twentieth anniversary of the first schedule mail flight occasions air mail week. Torrey Webb flew it out of New York to Philadelphia that day. Clark Edgerton brought it on into Washingon. They used JN4Hs. The H stood for Hisso. NY-DC took about 3½ hours. George Boyle took off the first load from DC for NY. But he came down in South Maryland. Mr. Edgerton says it was another man that made that flight, in another world. See these boys on the front page in May.

Northwest Airlines set Commerce and the Carlton buzzing the day they came to town about their passenger service being grounded (see page 58). If you must know, Northwest took a close decision on points. But Colonel Johnson and Fred Fagg took credit for a neat days work, and next morning Uncle Dan Roper wrote a nice honorable discharge for Mr. Hunter. Everybody seemed pleased, including Lockheed. Technologists say the accident represents the high price of knowledge gained. The newspapers tried to hang something on the Bureau but got no encouragement from any source.

Coast Guard Aviation will put some airplanes in Alaska next summer. Maybe it's just normal expansion, or maybe it's aimed at those Japanese boats poaching American salmon . . . Two cutters are carrying airplanes; in a matter of months seven cutters will carry them . . . The command will propose a patrol for the North coast's 300x100-mile iceberg field. Complete observation could be taken in one day by two planes.

Naval air forces will be increased in whatever proportion the Navy is increased if the President's plea for more sea power is answered by Congress. While a large section of the public and Congress resist U.S. entry into the armament race, testimony of the admirals, Mr. Roosevelt's influence and the promise of resulting good business, will carry us in.

Private flying, energetically sponsored by Gene Vidal, is feeling neglected of late. Several interested parties have been complaining on the bill that air transport is getting all the money and attention and most of the airway privileges while private fliers get onerous regulations. The Bureau of Air Commerce will be increasingly blamed for dropping small aircraft promotion. The National Aeronautic Association has obtained an agreement with the Bureau to hear an advisory committee on March 7. The Committee has several complaints but before further study mentions only the difficulty of renewing private licenses.

COVERS THE AIR FRONT: Devon Francis of the Associated Press has been awarded $250 and TWA'S trophy for " consistently developing the best informed writing" on 1937 aviation affairs.

TRAGIC LOSS: The industry lost one of its finest engineers and most admired personalities when Gerard Vultee crashed in Arizona on Jan. 29, while flying with Mrs. Vultee through a blinding snowstorm. Both met instant death. Vultee, at 38 years of age, had attained top rank among American aircraft designers. A graduate of Caltech, he was originally associated with Allan Lockheed and John K. Northrop in the development of the Lockheed "Vega." He served for some time as chief engineer of the Lockheed Aircraft Corp., and about five years ago established his own firm, developing the Vultee all-metal single-engine transport. This plane was manufactured by the Vultee Division of Aviation Manufacturing Corp., which later established itself in a factory at Downey, Calif. There the current Vultee attack-bombers were placed in production.

International

25,000 HP. SMILE: Al Menasco hefts his new 50 hp. unit. Aeronca has ordered 500. (See page 38 for details)

DH-3, DH-4, DH-2: Peter, John and Geoffrey De Havilland, sons of Capt. Geoffrey De Havilland. All are on the De Havilland Aircraft Company staff.

NEW V. P.: O. M. Mosier has left Braniff to be vice president of American Airlines.

AVIATION PEOPLE

Who's Who in This Month's News

EXECUTIVE SHIFT: From a long-time association with the Curtiss-Wright Corp., latterly as assistant to the president, Albert I. Lodwick (right) goes to Aviation Mfg. Corp. as executive vice president. He will serve under President Beal (above) in the general supervision of the reorganized corporation's several manufacturing subsidiaries. His resignation from Curtiss-Wright was effective Feb. 1.

NEW PRESIDENT: Elected to head up the reorganized Aviation Manufacturing Corp. is W. H. Beal (left), formerly president of Lycoming and more recently chairman of the board of New York Shipbuilding Corp. His activities will cover the Vultee Division, the Stinson Division and the Lycoming Engine Division. He served as a Captain of Ordnance during the war.

PUBLIC RELATIONS: To become manager of public relations for Curtiss-Wright, Ronald S. Gall will shift the scene of his activities from Paterson, where he has had charge of publicity (including the editorship of "Trade Winds") for Wright Aeronautical, to C-W headquarters on the New York side of the Hudson River.

Wide World

MAN AT WORK: Hawley Bowlus, pioneer American soaring pilot, holds the skeleton of his new sail plane. He plans to market it at $750 complete; $400 in kit form. It contains an airspeed, altimeter and rate-of-climb dial.

COUNTING THE HOUSE: James H. Dunbar, Jr., Jack Vilas, and Maynard W. Schryver, impressarios of Chicago's Air Show, get Valentine greetings in the form of the final accounting. Reflected in their faces is a satisfactory report.

LOGGING THE LINES

Air Transport Drift Sights by DAN SAYRE

Northwest Cleared by Bureau. General Outlook Improves.

That Northwest grounding business grew so complicated toward the end it's probably worth while fixing up a chronology of it. January 10th one of the line's eight new Lockheed 14 Zephyrs crashed near Bozeman, Mont., resulting in the first passenger deaths Northwest had suffered in eleven years. The Bureau of Air Commerce rushed a committee of investigators to the scene. Almost immediately came a Bureau of Air Commerce order grounding all Lockheed 14s. Inside dope outran official testimony. Official testimony outran concurrent flight test investigations. Flight test investigations outran the preparation of the official report. But the verdict turned out to be unanimous: That the crash had been caused by both fins and both vertical rudders being torn off the ship before it began its final dive—undoubtedly by flutter.

Now the Dutch had already raised the flutter question with Lockheed officials, and as a result the factory had developed a system of balance weights and suggestions for general beefing-up for the surfaces in question. Consequently long before the official findings were issued January 31st Northwest mechanics were rushing changes on the Zephyr fleet. February 5th word came that the Bureau, after checking its studies with the Air Corps, had decided to approve the Zephyrs for transport use as soon as they passed a new 50-hour service test. But the same day the Bureau tossed another bomb shell—"for failure of the air line to maintain its aircraft in an airworthy condition" the Lockheed Electra fleet in which Northwest had been maintaining a skeletonized service, must refrain from carrying passengers for two weeks.

Northwest alleged shortcomings even now remain the secret of a few air line and Bureau officials. Whatever they were, in less than a week after the second grounding order was issued, and following a visit of Croil Hunter to Washington, the Bureau crashed through with a reinstatement of all Northwest equipment, both Zephyrs and Electras. Sideline kibbitzers are divided about evenly on: (1) The Bureau, made "Northwest conscious" by the accident, had really found some state of affairs that justified the order; (2) The grounding of the Electras was merely a maneuver on the part of the Bureau to shift undue onus on to the air line for the Zephyr crash. Structual failure by flutter of a transport plane which had just been given full air line approval by Bureau engineers certainly brought into question the value of the Bureau's test procedure. Muddying up the reputation of the maintenance practices of the air line concerned tended to detract from the Bureau's share of the blame.

It's all over the dam now anyhow. The Roper statement reinstating Northwest's entire fleet dripped honey. The reinstatement was being made "after a thorough examination of the air line's maintenance," and the Secretary went out of his way to mention Northwest's excellent safety record. Officials of the air line evidently decided to say nothing and let the world forget it ever happened.

The free rides for wives idea that United started a month ago solely as something to be limited to its San Francisco-Los Angeles route spread like fire in a dope room. Before February was half over, United, American, and TWA were inviting wives to accompany their husbands as guests of the air line over practically their entire systems. At least four or five minor lines followed suit. The result naturally was a substantial increase in feminine patronage. United reported that the proportion of feminine passengers to total traffic had risen from a normal 25 per cent to something over 35 per cent. More than 60 per cent of the ladies riding as guests were found to be making their first trips in modern twin engined transport aircraft. At least 95 per cent of the new riders expressed themselves as completely sold hereafter on air travel. All in all, most traffic managers we have contacted think the hunch was a constructive one. Only fear is that it might be difficult to stop March 1st as everybody seems to be planning.

Incidentally the Air Line Feeder System, operating between Newark and Springfield, Mass., via Bridgeport, New Haven and Hartford, went further with the idea than any one else. It broadened its invitation to sisters, mothers, fiancees, or just plain "girl friends." While we are on the subject, there seem to be no flies on the Feeder System's traffic department. It is now offering riders a "commutation ticket" service which brings the cost of travelling on their line down to about 3½¢ per mile. The ticket resembles a meal ticket such as you used to get in an old-fashioned beanery, only instead of the units to be punched out being nickels and dimes, each one represents 20 miles of air travel. (The Feeder Line System's stops working out almost exactly in such units.

After all that excitement over the new air mail route between Burbank and Juneau, Alaska, by way of White Horse, Pan American's subsidiary Pacific Alaska Airways turned out to be the only bidder and presumably will be awarded the contract. Or rather contracts, for the route is considered as two separate and distinct legs, one from Fairbanks to White Horse in the Canadian Yukon; the other from Yukon to Juneau. Pacific Alaska's bid on the former was 0.80 per mile; on the latter, $1.55 per mile.

Don't look now, but the country's domestic air lines have a first-rate safety record in the making. For eleven months following the TWA crash over Pittsburgh, there have been only three air line accidents which resulted in passenger fatalities. They are, of course, the Eastern Air Lines' trouble with a power line pole in Florida. United's disaster in Utah, and North-

MOCK-UP O. K.! Right: TWA and Pan American officials have passed on final layout details of the Boeing 307. First of eight of the four-engined giants is due out in June. Pan Am's will be equipped from the start for sub-stratosphere super charging. TWA'S may be so equipped with a minimum of changes.

Upper Left: The big cabin is 11 ft. 7½ in. by 32 ft. 6 in. and will seat 33. Lower Left: Cross-wise berths will sleep 16. Below: Jack Frye and Paul Richter of TWA check over the big control room with Boeing's C. L. Egtvedt. Dimensions of the big ship: Span 107 ft. 3 in.; Length 74 ft. 2 in.; Gross Wt. 42,000 lb.; Power plant: four 1220 hp. Wright Cyclones.

west's Zephyr crash. It wouldn't do to sit down and compute the exact passenger mileage per fatality or the airplane mileage per fatal accident—yet. But it obviously would make the record for the eleven months preceding look pretty terrible.

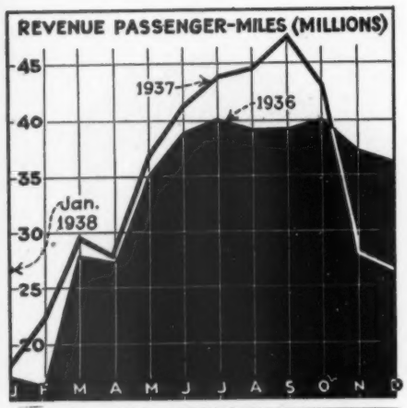
Keep your eye on the air transport indicator that we run as a regular part of this department each month. You may still think your traffic is disappointing and not what it rightly should be. But for the first time this winter the figure (for January) is way up over 100. In other words, we're starting the year out by licking the corresponding period of 1937 by a wide margin. If we can keep on doing that through the year—and why not—the industry ought to start getting away from that horrible red ink effect that is featuring current airline bookkeeping.

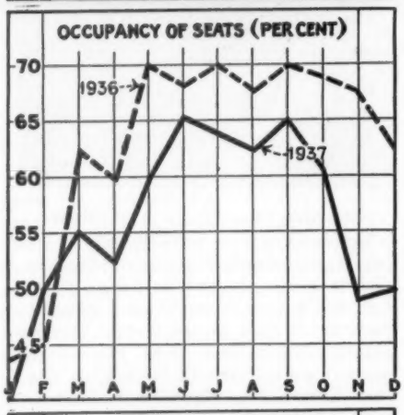
The indicator figure is, of course, the ratio of revenue passenger miles flown in January, 1938, to the corresponding figure for 1937. Data from the A.T.A. Reports from individual companies show that in January, 1938, UAL carried 17.6 per cent of the total carried by all air lines; Eastern carried 21.3 per cent; TWA carried 17.4 per cent. American's share was 27.5 per cent.

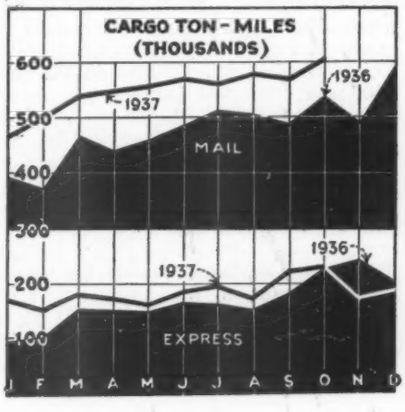
AIR TRANSPORT INDICATOR

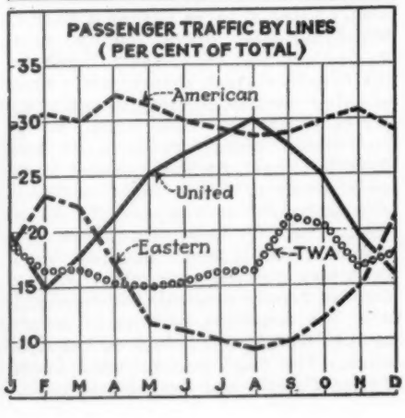
February 1, 1938

150.6









AS OTHERS FLY IT

A Birdseye-View of Aviation Abroad

A propeller unit of Britain's shadow factory system, started in February of 1937, has been finished and set into full operation. Managed by the DeHavilland Aircraft Company, the plant is located at Bolton, Lancashire, and is to produce propellers of all sizes between 100 hp. and 1,700 hp. 400 employees are already at work. The large majority of current British production designs call for DH propellers. . . . The Short Mayo Composite has finally been put through the final stage of its very deliberate flight testing. Taking off together as a unit, the upper and lower components were successfully separated in mid-air early in February. The pilot of the lower component, John Lankester Parker, described the sensation when the catch was released as a "kick in the pants." We await with interest the Air Ministry's decision to utilize the Composite for trans-Atlantic tests. . . . Tests on the big 4-engined DeHavilland Albatross, which have been under way for several months, are nearing completion at Martlesham, an Air Ministry testing center. Five are on order for Imperial Airways, and are to be used on that company's services to nearby European capitals. . . . The American built Burnelli UB-14, which Clyde Pangborn took to England last year, only to ferry it to Holland to avoid the high British customs tariffs, is now back in England.

Acme

MARIO (Non-Stop) STOPPANI

At Christmas this veteran Captain of the Italian Regia Aeronautica held no less than 17 official F.A.I. records. In fact all but two established category records of load and distance for seaplanes (above the light plane categories) were listed to his credit. Then just before the New Year Stoppani with a crew of three pushed a Cant-Z 506 flying boat (three 750 hp. Alfa Romeo engines) from Cadiz, Spain to the Brazilian coast, thereby set a new non-stop distance record for all categories of seaplane—4200 miles. Early last month while fifty miles off the Brazilian coast, Stoppani turned back on a projected return flight to Cadiz and as he did so attempted to dump fuel. The ship burst into flames and crashed, killing four. Stoppani however was rescued by a plane of the German Condor syndicate which landed near the wreckage in spite of rough seas to find Stoppani injured but still alive. The four dead included Capt. Enrico Comani and Capt. Mario Viola.

The British are very proud of a recent flight of a Royal Air Force officer in a Hawker Hurricane single-seater fighter. Taking off at night from Edinburgh, he pushed it through to a field west of London at an average speed of 409 m.p.h. A 50-mile an hour tail wind admittedly helped out considerably, but it is nonetheless a reassuring measure of the general performance of the ships Great Britain is receiving from its quantity production program. . . . The Portugese government has contracted for 15 single-seat Gloucester Gladiator fighters to be delivered within six months. A recent order from Portugal for 12 Avro Trainers has been filled.

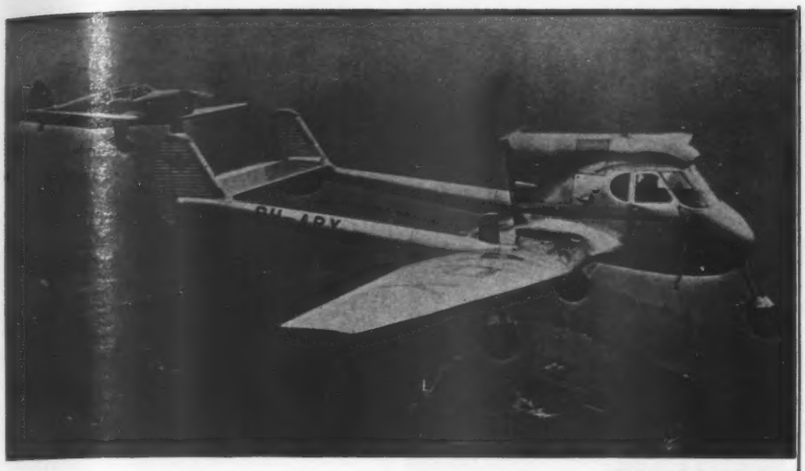
The Montreal Light Aeroplane Club, one of the leading organizations of that type in Canada, has just reported on a record-breaking year of activities. Club members booked 1,047 flying hours during 1937. This included 371 hours dual, 270 hours solo, and 330 hours of flying with passengers. In all the Club's activities not a single accident occurred throughout the year. A wide variety of instruction and practice facilities was maintained — ground school lectures, instrument training, night flying training, cross-country work, and general preparation for license examination. Officers elected for 1938 are: Dougal Cushing, president (to succeed Dr. D. P. Mowry). Vice-presidents, Capt. G. R. Beck and Dr. R. Simard. Honorary Secy.-Treas., Leslie Choyce. Directors, A. A. Monson, F. W. Dougherty, D. R. Couture, C. H. Kenyon, H. Wisenthal and D. D. Thomson.

The Turkish National Assembly has voted an appropriation for additional aircraft procurement of $6,250,000. . . . The Chilean National Air Line, which recently was authorized to float a loan for the procurement of five all-metal transport planes, has placed an order for two Junkers-86 monoplanes. It is understood that a decision on the remaining three has not yet been reached.

The Russians have a new engine, designed by the engineer Mikulin, which is considered one of the best yet developed in the U.S.S.R. The new engine, which is to be known as the AM-40, is reported to have an output of about 1,200 hp. . . . The trial of Army Commander Alksnis, head of the Red Air Force and of the designer, A. N. Tupoleff, is understood to be under way as a part of the long drawn out purge of Russian army and industrial personnel. The General is not well enough known in this country to enable us to form any opinion of his capabilities. But any designer good enough to produce the ANT aircraft which made last year's trans-Polar crossings would seem, from this distance, to be an asset the Russian aircraft industry could hardly spare. . . . As we go to press, the Russian party which has remained on the Polar ice floe for nearly nine months is still awaiting rescue off the coast of Greenland. The value of this spectacular venture can hardly be underestimated. Obviously it was of basic importance in the Polar crossings. No less valuable has been the daily weather observations transmitted from the party's radio station to the World's forecasting bureaus. . . . Unfortunately the problem of rescuing the party from their current predicament led to the loss early in February of the Russian airship V-6. The brief announcement of the crash indicated the ship had struck a mountain near the edge of the White Sea while on a practice flight preliminary to a dash to rescue the weather party. The cause

ENGINEER FURIO NICOLET

Holds 7 international records. He and Stoppani alone lead all nations save France and the U. S. With a few other Italians they beat everybody.



Underwood & Underwood

YOU CAN'T BEAT THE DUTCH: With the DC-4 in prospect and a general trend underway toward three-wheel transports, KLM has imported this Stearman-Hammond for pilot-training.

was not definitely stated, but it was believed to have been caused by poor visibility.

An aerial traffic jam over the South Atlantic is not so much of a pipe dream prospect as you might think. A British mission made up of Air Ministry officials and representatives of British Airways, Ltd., has recently been over the ground of a proposed route from England, down the coast of Africa, then across to Brazil, with possible future extensions to the British West Indies. Definite preparations are expected to start within a few months. Then on top of that the Italians announced plans for establishing a complete mail, express and passenger service from Italy to South America sometime during the current year. The Italian announcement followed closely upon the arrival of Mario Stoppani in Brazil, after a long-distance record flight from Cadiz, Spain. Since the Italian plans call for passenger service, the French have speeded plans to put their now veteran mail line on a complete transport footing. Presumably Deutsche Lufthansa will also proceed to modify their operating technique to make some provision for passengers.

It Pays To Tour

A REPORT released by Ben S. McGlashan, president of the Aviation Country Club of California, Inc., shows that club members to date Jan. 22, 1938 have flown more than 750,000 passenger miles on club tours which totalled 2,615 airplane hours and consumed 31,380 gallons of fuel and 849 gallons of lubricating oil. The club membership now totals 195 persons representing ownership of 88 airplanes. The club makes no assessments, members pay no dues, yet the current bank balance is reported at $653.73. All income is from initiation fees and tours.

AVIATION BOOKS
In Tabloid Review

JANE'S ALL THE WORLD'S AIRCRAFT, *compiled and edited by C. G. Grey and Leonard Bridgman;* Sampson Low, Marston & Co., London, 1937; 650 pages, 2 Pounds 2 shillings.

Reviewing Jane's in its 27th year of issue is like lecturing an Air Corps squadron on the advantages of wearing parachutes. All aeronautical schools, libraries, engineering departments and publications already know they can't afford to get along without this biggest and best collection of airplane photographs, descriptions and data any one publishes anywhere. This 1937 issue is a little bigger and better than its predecessors. Our only regret is that such a thing cannot be produced in this country for anything like a comparable cost.

THE CHOSEN INSTRUMENT, *by Norman Macmillan;* John Lane, The Bodly Head, London, 1938; 168 pages, 5 shillings.

A small book you can, and will, read in one sitting. Reviewing the great changes that have been produced in international allignments since Germany began rearming in the air, the author discusses each power's position in case of another world conflict. Of special interest is his stressing of geographical factors in aerial defense; the radically changed role of neutral countries in new concepts of warfare; the various measures Great Britain might take for her defense. Macmillan finally comes up with the suggestion that Britain base her major aeronautical factories and forces in Canada. It might be even safer to move all those people off those little islands into Canada, South Africa and Australia.

METAL AIRPLANE STRUCTURES, *by Major Flavius Loudy;* The Norman W. Henley Publishing Co., New York, 1938; 455 pages, $5.00.

A descriptive and graphical treatment of the whole field of metal construction in aircraft. It has therefore much to recommend it to designers, draftsmen, engineers who prefer to avoid the rigors of complex mathematics. It is therefore also limited in the depth of its treatment of many fundamentals. The whole book suffers, too, from the author's selections of such dodoes as the DO-X the Sikorsky S-40, The Junkers G-38, the Ford trimotor, etc.

Williams Heads Licensed Airmen

CLOSING THEIR FIRST YEAR of organization activity the Licensed Airmen of America a chapter of the NAA located in Los Angeles, recently held the first annual election of officers since formation of the society and named P. E. Williams, (Douglas Co.) president; A. B. Powers, (Lockheed Corp.) vice-president; John Andrews (North American Aviation) treasurer; W. G. Leugers (Lockheed) Secretary; and P. W. Hairgrove, H. C. Buck, J. D. Staggs as committee chairmen in charge of publicity, membership and educational activities respectively. Charter president of the organization was L. H. Steward of the Bureau of Air Commerce. Purpose of the Licensed Airmen of America is to band together all persons holding any form of Government aeronautical license.

A Base Across the Bay

The Bureau of Yards and Docks, Navy Department, has awarded a contract to the San Francisco Bridge Company in the approximate amount of $940,000 for waterfront improvements incident to the construction of the new Naval Air Station at Alameda, California. The project includes stone seawalls and jetties, sheet pile bulkheads, a gasoline and oil pier, and approximately 4,000,000 cubic yards of dredging and fill. The contract time for completion is 330 calendar days.

Two-Plane Family

CHARLES H. BABB, international aircraft broker at Grand Central Air Terminal, Glendale, Calif., reported the sale of a Northrop Delta "Executive" type cabin plane during January to Baker Oil Tools, Inc., Houston, Texas. The plane is to be used for executive transportation in the Texas area and between Texas and California. Babb also reported the sale of a Fleet Model 8 three-place plane to R. C. Baker, son of the president of the Baker Oil Co.

THE REPORT CARD

Of Air School Developments

» STUDENTS WHO REGISTERED recently for the winter class at the Boeing School of Aeronautics (Oakland, Cal.) represented twenty-two states, Australia, Canada and New Zealand. . . A survey has shown 60 percent of all Boeing graduates are working in the air transport industry.

» PARKS AIR COLLEGE (E. St. Louis, Ill.) has installed a Link trainer in its South hangar building. Since the Bureau of Air Commerce permits Link trainer time to count for half the 20 hours needed for an instrument rating, Parks students are expected to keep the new installation plenty busy.

» THE LINCOLN AIRPLANE AND FLYING SCHOOL (Lincoln, Nebr.) has issued a new catalogue describing thirteen different courses of instruction. . . Advanced flight training students are given a 3,000 mi. X-country observation flight in a TWA airliner before graduation . . . Lincoln School has made arrangements for students to earn substantial sums toward their room and board expenses through part-time odd-jobs around the school plant.

» THE SPARTAN SCHOOL OF AERONAUTICS will open night classes in their school, Jess Green, director, has announced. John M. Welch, aeronautical engineer of the University of Tulsa faculty will conduct the classes. Green has been elected state governor of the National Aeronautic association succeeding Duncan McIntyre.

» THE NATIONAL YOUTH ADMINISTRATION in Escondido (Cal.) has started a trade-school training course for a number of its members in aircraft sheet metal construction. The course specializes on aluminum alloy products but includes other metal production as well. The project is under the supervision of Vernon Gustafson and Henry Kirkpatrick. Engel Aircraft Specialties is furnishing the National Youth Administration with facilities as well as assisting in an advisory capacity.

C-W TECH GETS NEW PROF.: F. R. Shanley (left) is welcomed by Major C. C. Mosley upon his arrival to take up duties as Chief Engineer of the Curtiss-Wright Technical Institute, Glendale, Calif. Shanley has a brilliant background with Consolidated, Hall-Aluminum, and the Bureau of Air Commerce, and will retain a consulting connection with Consolidated. He succeeds Carleton E. Stryker, who has left to take a position with the Bendix Corp.

» THE OIL CITY (Pa.) AERO CLUB is sponsoring an aviation ground school under the supervision of the Pennsylvania State College Extension School. Classes are to be held at the local Y.M.C.A. The instructor is J. P. Bauer, graduate of the University of Colorado and New York University, who has taught aeronautics at the Carnegie Institute of Technology.

More Plush for Sailplainers

WITH THE SOARING SOCIETY OF AMERICA again selecting the Harris Hill Glider Field, Elmira, N. Y., for the Ninth Annual National Soaring Contest, to be held June 25 to July 10, it is expected that the work now in progress there will be completed in time for the meet.

Additional improvements to the Harris Hill Glider Field and the Chemung County Youth Camp were assured by the recent allocation of $48,313 in Federal Funds to a new WPA project requested by the County Board of Supervisors. In addition the share of the cost which will be borne by the County, amounts to $15,086.

Plans for the new project, according to the magazine "Elmira," call for the construction of a recreation and assembly hall, fifteen additional sleeping cabins, five comfort cabins, a combination garage and storehouse and an athletic field.

Under two previous WPA projects a total of $113,808 was expended for the improvement of Harris Field and the creation of the Youth Camp. This included the grading of fifty acres of the field and improving two miles of the road approach to the site. The present administration building, five sleeping cabins, a hangar and one comfort cabin with shower bath were erected. In addition a runway 2,000 ft. long and 100 ft. wide for the take-off of gliders was graded and rolled.

Work accomplished under the original project, under which the Youth Camp was started, consisted of the construction of a concrete swimming pool sixty feet in length by twenty-five feet in width, the erection of five sleeping cabins and the improvement of the approach road.

The Air Corps Wants You

Posts $500 Bonus to Fill New Randolph Field Training Quotas

ARE YOU between 20 and 26 years old? Can you pass a good stiff physical exam? Have you been two years at college or possess the equivalent in general savvy? If you fill that bill, the U.S. Air Corps wants you—badly. Speeded-up plane procurement and continual drain on Air Corps personnel by the airlines has finally brought on a very definite shortage of Air Corps flyers.

To fill up present and future vacancies the size of this year's Spring class at the Randolph Field (Texas) Training Center has been boosted from the usual 150 to 344. And the Air Corps found it had to scurry around to get enough applicants to fill the quota. Instead of insisting candidates come in for a general interview, several corps areas organized "flying squadrons" of officers to visit colleges and other centers to answer questions and spread the message. On top of that a $500 bonus was offered to be paid at the end of three to five years active duty.

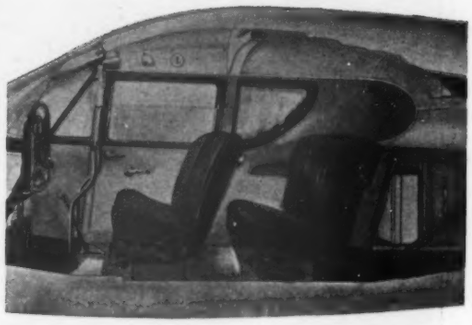
Even without the bonus the Corps offer is darned attractive. Cadets receive $75 per month and all expenses during their training year which includes thorough ground school instruction and about 323 hours of flying. After that graduates have at least three years of active duty as Second Lieutenants at more than $200 per month pay plus allowances. Chances of transfer to the regular army during those three years are excellent; or airline employment certain at the end of them.

Our Defenses Grow Stronger

IF AN ENEMY FORCE ever does move into San Francisco and transform the St. Francis Hotel into a honky tonk, it won't be because our armed forces failed to appreciate the importance of mid-Pacific air defenses. Since last we went to press the Air Corps has moved the 31st Bombardment lock stock and barrel from Hamilton Field (Cal.) to a permanent assignment in Hawaii.

It has Everything!

THE NEW FOUR-PLACE FAIRCHILD "24" COMBINES SUPREME QUALITY, HIGHEST PAYLOAD FOR HORSEPOWER, LOWEST OPERATING COST, UNEQUALED FLYING EASE, EXCELLENT PERFORMANCE, UNCANNY SAFETY AND DISTINGUISHED STYLING TO BECOME AMERICA'S MOST LOGICAL PRIVATE-OWNER CHOICE



Room and Comfort for Four--
A large baggage compartment and shelf for hats and overcoats add greatly to passenger comfort and convenience. The payload exceeds that of any plane in its class. Other planes of equal payload cost nearly twice as much to operate.

Fairchild owners will tell you that the new "24" is the best cabin plane in the world to own. They claim this for several reasons: (1) *It is easy to fly.* The perfect rhythm of its responsive performance, its absolute safety, its complete lack of "tricks" make the owners feel at ease no matter how old or young, inexperienced or "rusty" they may be. (2) *It is economical to own.* Starting at a price which is the lowest for any 4-place cabin plane and combining this with an operating cost of about ½c per mile per person, the "24" saves its owner several thousand dollars during a 1,000 hours of flying. (3) *It has excellent performance.* Cruising speeds of 124 to 130 mph., long cruising range and phenomenally short take-offs and landings are made to order for the private owner. (4) *It excells in quality and beauty.* Considered America's finest personal cabin plane, its outstanding value and distinctive styling is appreciated particularly by those who can pay a great deal more. Before you buy a personal ship, talk to a Fairchild owner—or let us demonstrate at your convenience. Full details on request.

Easiest to Fly--
The "24" reduces flying to the simplest, easiest, safest and most enjoyable terms yet offered to the private owner.

HIGHEST QUALITY AND LOWEST OPERATING COSTS
Highest Payload in its Class ● Complete Ball-bearing Control System ● Sand-blasted Fuselage ● Cadmium plated Fittings ● Anodized Aluminum Alloy Parts ● Push-Pull Tubes for Ailerons and Elevators ● Rounded Windshield and Crank-operated Windows ● 9'2" Gear Tread and 7" Oleo Travel ● Distinctive Beauty ● Split-balanced Flaps on Deluxe Models ● Powered with Warner 145 H. P. or Ranger 165 H.P.

FAIRCHILD AIRCRAFT CORP.
HAGERSTOWN, MARYLAND

AMERICA'S MOST LOGICAL PRIVATE-OWNER PLANE

THE *Fairchild "24"*

LIFE-SIZE!

If there's room in the cockpit for this picture, there's room for the MIDGET TRANSMITTER!

WESTERN ELECTRIC'S new 25A Multi-Frequency Transmitter for private flyers transmits either radio telephone or telegraph on any frequency between 2800 and 6400 kilocycles—yet it *costs less than single frequency units!*

Transmits on private flyer frequencies of 3105, 3120 and 6210 kc.—and on any airline frequency for which your plane is licensed.

One-hand-shift from one frequency to another. No complicated remote controls.

Built-in relay, so that you can use same antenna for transmission and reception.

Push button control on microphone for 2-way telephone: push to talk, release to receive.

Crystal controlled, giving more than 15 full watts carrier power. Tuning meter shows power delivered.

Audio power unit separate—may be mounted anywhere convenient.

Audio-power unit measures 10" x 6⅝" x 6⅝"

Weight less than 23 lbs. complete—including audio-power unit, radio frequency-control unit, microphone and cables.

Easily installed by plane manufacturer or your local aircraft organization. Complete cables with plugs are included.

For complete details on this low cost, high performance midget, write to Western Electric Co., Dept. 317A, 195 Broadway, New York.

For simultaneous reception, get Western Electric's approved 724A Filter — immediate delivery.

Western Electric

Northern Electric in Canada

TWO-WAY AVIATION RADIO TELEPHONE AND TELEGRAPH EQUIPMENT

Thirty officers, 180 men and thirteen Douglas B-18 bombers were involved in the transfer which was carried out by the transport "Republic." Estimates of Air Corps strength in the islands place it at 150 planes with the Corps definitely committed to building it into one of the strongest composite wings of the GHQ air force.

Mid-Pacific Navy strength is at about 75 units with several more squadrons of patrol bombers scheduled for flight-delivery later this year. Now "an unusually reliable source" states that Squadron VP-18, now at Pearl Harbor, is soon to be transferred before June to Guam with all fifteen of its patrol-bombers.

Troops Reach Denver—At Last

THREE HUNDRED ENLISTED MEN, 35 officers and 30 train carloads of equipment arrived at Denver, Colo., Feb. 12 to man the new army air corps technical school. The troop movement was ordered after the Denver city council adopted a resolution guaranteeing the federal government that the remainder of the lands (approximately 40,000 acres) needed for the school will be acquired by the city and turned over to the War Department by April 1. The land is needed for a 64,000-acre bombing range 15 miles east of Denver, and for a corridor which will connect the range with an auxiliary landing field.

Fifteen engineers and surveyors recently began survey work to determine what work must be done on the auxiliary landing field before planes can land there. The auxiliary field is about two miles from the primary field and school headquarters.

Army To Expand Mitchell Field

THE WAR DEPARTMENT has started condemnation proceedings to add 350 acres along the south and west sides and at the northwest corner of Mitchell Field, chief Air Corps base in the New York area. Cost of the new land is expected to reach $1,500,000. More than $3,000,000 has been spent at Mitchell since 1929 in replacements of old wartime shacks with modern brick housing for personnel and offices.

Prop-Brakes for Dive Bombers

THAT OLD TERMINAL VELOCITY CONFUSION that has so far featured the gentle art of dive bombing may soon be a thing of the past. The Navy's Bureau of Aeronautics has disclosed a long program of experiments, now nearly completed, toward the development of a reversing propeller. A logical development of full feathering devices already perfected, such a reversible prop would hold the diving ship to any desired velocity and permit absolute accuracy of bomb placement. Both the Hamilton Standard Division of United Aircraft and the Curtiss-Wright Corporation are reported to have been working on the project with the Navy.

International

LIEUT. COMMANDER SPENCER H. WARNER, U.S.N.

Won a neck-full of leis for commanding the Navy's recent "routine delivery" of 18 patrol-bombers to Hawaii.

LIEUT. BENJAMIN S. KELSEY, A.C.

Won the Distinguished Flying Cross for staying with a burning bomber, landing it and extinguishing the flames.

C.G. Tests Tough-Water Boats

THE COAST GUARD is running acceptance tests at Cape May, N. J., on the first of seven big "rough-water" flying boats on order from the Hall Aluminum Aircraft Corp. of Bristol, Pa. Designated the PH_2, the new ships are developments of the navy PH-1 which demonstrated some of the best rough water characteristics of any Navy aircraft. Power is by two Wright Cyclones, cruising speed at 2,800 ft. is 152 m.p.h. Range is twenty hours. Beside a crew of four, ship-wreck-rescue capacity is estimated at twenty. Cost, complete with elaborate radio and instrument equipment, will be about $120,000 per plane. The new ships are to be distributed to key Coast Guard bases in the East, South and West.

THE FLIGHT PLAN

Of Coming Events

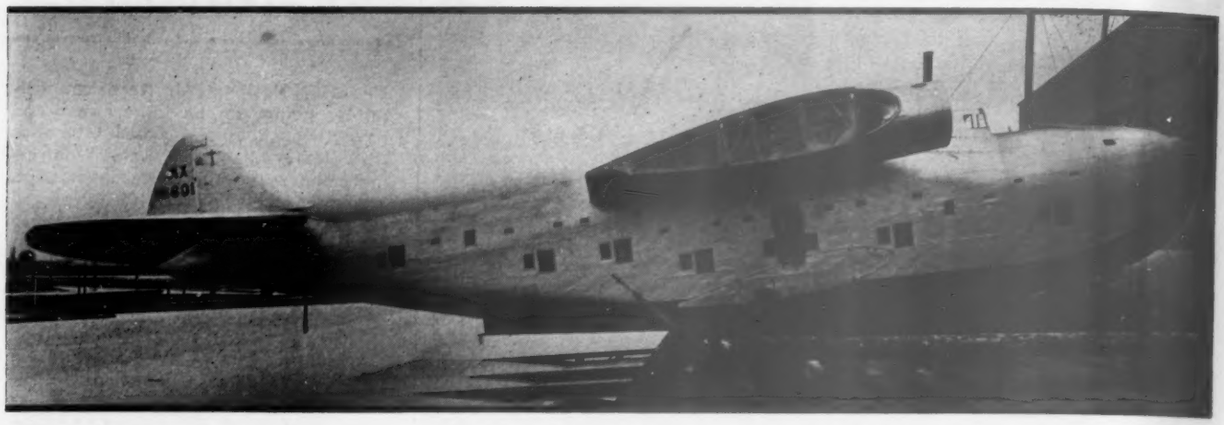
The 1938 National Air Races are certainly going to be different. The newly issued official schedule makes that clearer than ever. Aside from being compressed into three days (Sept. 3, 4 and 5) and having $102,750 posted in prize money there will be these changes (1) No 397 cu.in. race; (2) No qualifying races; (3) No Bendix Race plane can get into the Thompson or Greve; (4) Only 15 planes allowed in any race; (5) All Thompson and Greve must qualify by 6:00 P.M. of Sept. 2. (6) The Thompson will be for 300 miles; the Greve 200 miles; both over a 10 mi. course. Ludlum Trophy money for breaking the Thompson record of 264.261 m.p.h. is up to $4,000. The management is seeking a sponsor for the Women's Race.

Look for a bigger year than ever in the light-plane field. Piper which turned out 707 Cubs last year is out this year with a much larger advertising campaign and a red hot sales idea. Henceforth all Cub purchasers will be given free flying instruction—at least eight hours dual under properly rated instructors. Goal is to make such instruction available through distributors and dealers at 500 points in the U. S. Aeronca, which sold 278 in 1937, has announced an order for 500 of the new Menasco 50-hp. engines. Taylor-Young (producing 368 last year) is refinancing to permit substantially larger operations.

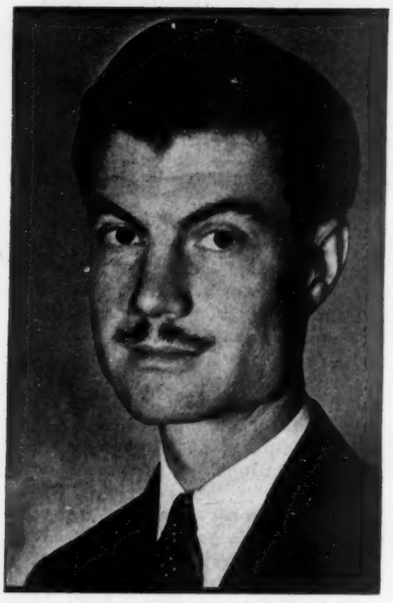
No one need miss a Regional Planning Conference this year. There was one for the Northwest last month. March 11-12 there will be one for the Southwest at Oklahoma City. April 14-16 Montgomery (Ala.) plays host to Southeastern planners. Eastern brain-trusters meet in May and so on. We will announce them as exact dates and data becomes available.

Don't Forget: The Third Annual Aircraft and Boat Show at Los Angeles April 2-10, Birmingham's Eighth Annual National Air Carnival June 4-5. Oakland (Cal.) International Air Races June 10-12.

Boeing Rushes Final Work on Clippers

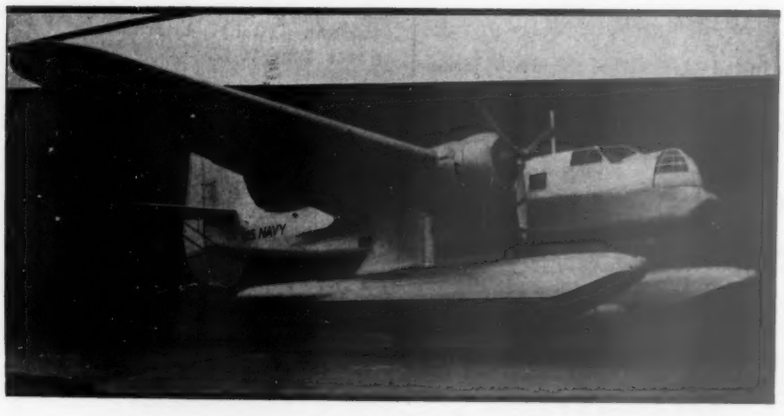


OUT OF DOORS: Construction work has progressed on the first of six Boeing 314 Clippers to the point where no building can hold it. Here it is on the launching ways, ready for attachment of wings and the mounting of its four 1500 hp. two-row Wright Cyclone engines.



CHIEF ENGINEER: Richard Palmer steps into new post at the Vultee division of the Aviation Manufacturing Corp. A Caltech graduate, Palmer, 34, has designed for Douglas, Lockheed, Vultee. Most spectacular achievement—Howard Hughes' record-breaking racer.

LINKS AROUND THE WORLD: News that George Vaughn and Richard Watham are in Europe for the J.V.W. Corp. brings out that Link Trainers have gone to England, France, Belgium, Holland, Italy, Roumania, Poland, Switzerland, Turkey, Australia, South Africa, South America, Japan. England alone has received 60. Total production to date 250. Orders on hand 200. Average unit value $7,000.



TORPEDO BOAT: Navy gives us first glimpse of a long-time secret project, the Hall-Aluminum XPTBH-2 for patrol, torpedo, and bombing. Power plants are Pratt & Whitney twin-row Wasps, driving Curtiss electrical controllable props. Span is 79 ft. 4 in.

Selling equipment to air lines is only half the Douglas sales job. The other half consists of selling the speed, comfort and security of these airplanes to the traveling public. Douglas advertising in national magazines reaches over 4,000,000.

The universal use of Douglas Planes by airlines has made air travel a family affair. Wives and mothers appreciate the comfort and security of these modern, most proven air transports in the world. With special travel inducements and fares at all-time lows, now is the time to "go Douglas." Douglas Aircraft Co., Inc., Santa Monica, Calif.

DOUGLAS

America's Largest Builder of Commercial and Military Aircraft

LAS" WHEREVER YOU TRAVEL

American Airlines Inc. . . . Braniff Airways . . . Eastern Air Lines . . . Pan American . . . United Air Lines . . . Western Air Express . . . Wilmington-Catalina Airline . . . Pan American Airways . . . Pan American Grace Airways . . . AUSTRALIA: Air Australian National Airways . . . EUROPE: A. B. Aerotransport, Sweden . . . Air Avio Linee Italiane, Italy . . . C. L. S., Czechoslovakia . . . K. L. M., Netherlands . . . L. A. R. E. S., Roumania . . . LOT, Poland . . . Swissair, Switzerland . . . ORIENT: ...tion Corporation . . . K. N. I. L. M. in Netherlands Indies . . . Japan Air Transport

Solving Space Structures Graphically

(*Continued from page 29*)

solved in the same manner and the loads in J' and D' are found to be of the same magnitude as those in J and D, but of opposite sign.

The resultant load at (3) could be found by laying off the stresses in J and J′, but since the latter two are numerically equal, the horizontal components (left and right components) are seen to balance each other, so that only the vertical components need be considered. This gives R_3 and the determination of the stresses in K and K′ is made in the usual manner followed by the marking and by the laying off at joints (11) and (12).

This completes the solution of all the members of the front bay of the engine mount structure.

An examination of the joints (11) and (12) shows that there are too many members of each, so that we must first solve joints (8) and (9), each of which has only three members (the others are now applied stresses).

Care sould be exercised in the determination of the applied resultant load at the various joints. It is best, starting with one view, say the top view, to take care of all the stresses in that view first and then to consider the top projections of the stresses in the side view members which end at the particular joint in question.

Thus, at joint (9) the stress in A' is taken as the first applied load; on a line thru its end and parallel to H' is laid off the stress in H'. Thru the new point is drawn a line parallel to G and the stress in G is laid off on it. This takes care of the loads in the top members. There remains the load in the side member B′ (See isometric sketch). Since the top projection of B coincides with A' and, project the stress in B' on A′ and, drawing a line parallel to A′, we lay off at the last end point the magnitude of the top projection of the stress in B′. The resultant R is a vector drawn from joint (9) to the last end point and pointing toward the latter.

The presence of any applied external load at joint (9) would not complicate matters much. It would only require one more vector parallel to the applied load and equal to it in magnitude.

The same procedure is followed now in determining the side projection of the resultant load at (9); here the stress in B′ is taken as the first applied load; the stresses in G, H′ and A′ are then projected on A (in side view) and these projections (or their vector sum, since they are all collinear) are drawn at the end point, thus determining the reaction R_4. (In this case it happens that this sum is zero; this is, however, merely accidental). As a check on the correctness of the move, the last end point in the side view must lie exactly below the same point in the top view. By inspection joint (9) is found to represent case *4b*. Therefore, either view may be solved independently of the other. This gives the stresses in P, Q′ and R′.

A WORD OF CAUTION with regard to the determination of the resultants R; in general the applied loads may be drawn either with their tail end or with their front end touching the joint; but once the first applied load has been drawn with its tail end at the joint all the other loads must follow in the order indicated before and the resultant R will have its tail end at the joint and its front end at the front end of the last vector. If, however, the first applied load vector has been drawn with its front end at the joint, the resultant will have its front end at the joint and its tail end will coincide with the tail end of the last applied load vector.

Joint (8) is also case *4b;* the resultant is determined as for (9) and the method of solution is the same.

The stresses in N and P are the applied loads at joint (10). Their vector sum gives the resultant R_4. Strictly speaking joint (10) cannot be solved since it consists of four members. However, inspection shows that the two crossbay members lead to joints (11) and (12) while M and M' lead directly to the supports. Since the supports are assumed to be rigid while the joint (11) and (12) deflect, and furthermore, since the resultant R_6 is in the plane of M and M', it may be assumed that it is taken entirely by the latter two members.

Turning to joint (11) and (12) we find that each of those contains four members. Since the maximum number of members we can solve for is three, this is a statically indeterminate structure. Selecting L as the redundant member, we proceed to solve the included determinate structure.

It consists of two tripods; one with its apex at (11) and the other at (12). Since neither view of these tripods has any superimposed members, they represent the general case and are solved by the general method.

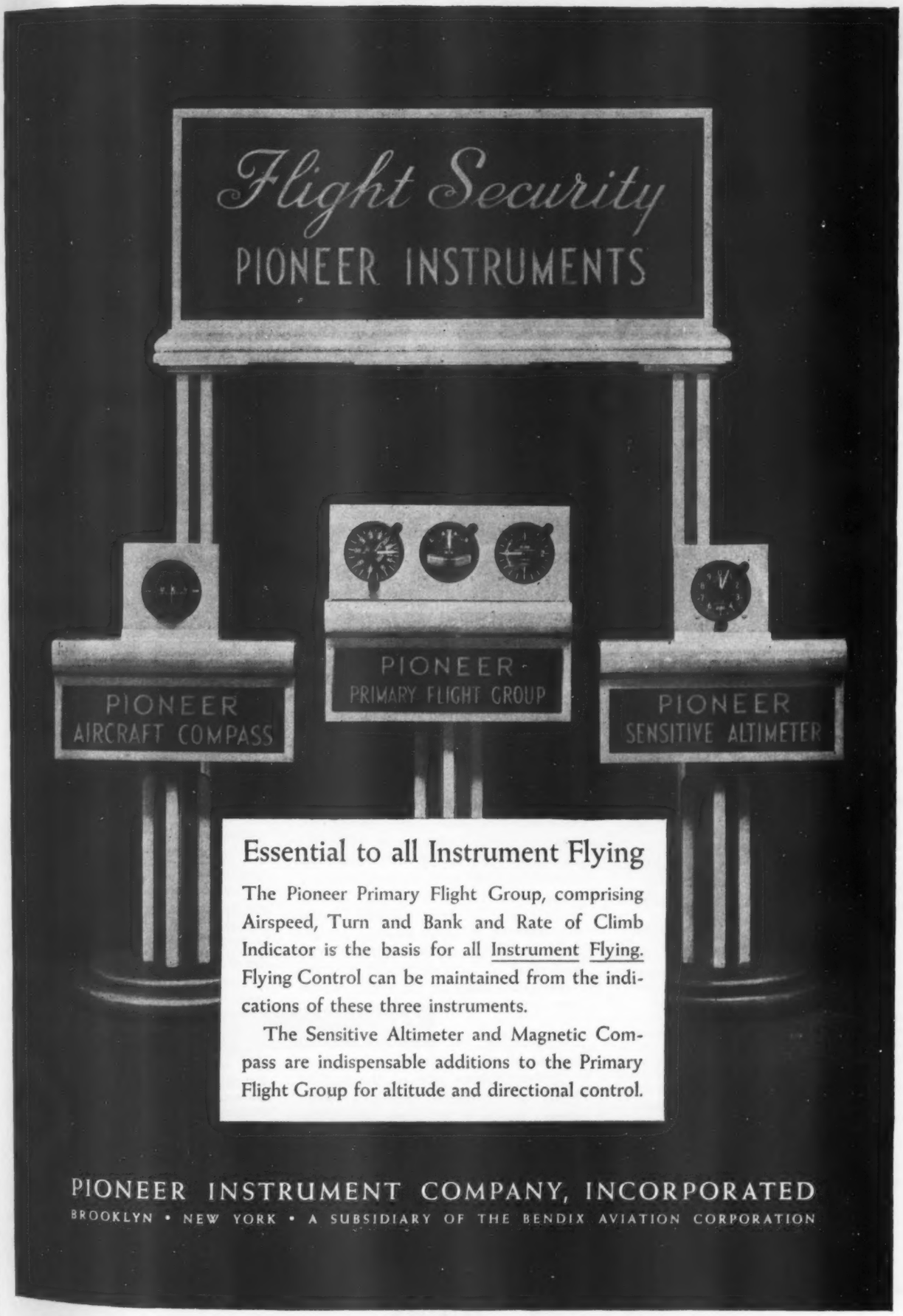
Starting with joint (11) we lay off in side view the stresses in C and Q and then the projection on D (in side view) of the stresses in D and K. This gives the side view of R_5. In the bottom truss the resultant is found by first accounting for the stresses in D and K and next for the projection on D of the stress in C.

After determining the two views of the applied resultant load, we name member S the F member, R'—the M member and U—the T member. This is carried out in both views. The procedure given for the solution of the general case is now followed exactly and can be identified by means of the letters designating the various points. The resultant stresses are scaled off at the supports and are marked correspondingly. The points marking the magnitude of the stresses in the side view must be exactly in line (vertically) with the corresponding points in the bottom plan view. (Note that the cross-diagonals R and R' as well as the side diagonals S and S' have points in both the top and the bottom truss. Their projections on the bottom truss were used in conjunction with their side view to determine the stresses in them.)

Joint (12) is solved in the same way as joint (11).

The next operation consists in scaling the stresses in all the members. The upper and lower trusses in the first bay are nearly in true view (their side projection is almost horizontal). Hence the stresses in their members may be scaled directly in the top and bottom plan view; members B and C, also B′ and C' form quite an appreciable angle with the horizontal in either view. Hence, the stress vectors have to be revolved first, in order to find their true length. In the second bay members Q, Q′, N and P are in the plane of the paper. The stresses can be scaled directly. T, T′, M and M′ are practically in the plane of the paper in the top view and may be scaled in that view. It will be found that small inclinations of members have practically no effect on their true length. (cos 1° = .9998; cos 5° = .9962; cos 8° = .990, or only 1% less than the true length). Members S and S' are almost horizontal in the bottom plan view, hence their stresses may be scaled in side view. R and R′ are out of the horizontal in both views. They must be revolved before the stresses can be scaled.

(*Turn to page 70*)



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Space Structures

(*Continued from page 68*)

This completes the work of determining the stresses in the members. There remains the determination of the reaction and the checking of the work. The reactions themselves supply an excellent check on the correctness of the solution. Treating the structure as a free body, we consider the applied forces and the reactions as the external forces acting on the body. If the sum of the vertical, horizontal and side forces is zero for each direction respectively, the solution is correct. In the special case when the structure is loaded by a torque, the moment of the reactions (i.e. the components of the reactions in a plane parallel to the plane of the applied torque) around any point must be equal to the applied torque.

At any support the horizontal component of the reaction is the vector sum of the horizontal projection of all the members at this support. A similar reasoning is true for the vertical and side components. The ΣV, ΣH, ΣS is then found and each must be zero.

Fig. 6 shows how the reactions are found and how the above check is made.

The stresses at any particular joint can be checked in a similar manner by finding the projection of the stresses along the main reference axes and summing up the vectors. The components of the loads and of the stresses along an axis must cancel each other. The check of the stresses at joint (11) and (12) (the general case) is given by the fact that in each view the stresses are parallel to their respective members and the stresses in one view are true projections of those in the other (or corresponding end points of the stresses lie vertically below each other).

General Remarks

This method requires some study of the structure before the analysis is begun. It is necessary to establish the correct order in which the joints are to be solved. It is, therefore, less mechanical than the stress diagrams for plane trusses, but it also gives a better insight into the distribution of stresses in structures in general and into the advantages or disadvantages of various types of structures.

It is particularly useful in cases where the component trusses of the structure are irregular and deviate greatly from a plane structure. This is often found when the structure has only three supports or when the cross-bays are triangular, or when there are cross-diagonals in some of the bays.

Its accuracy is the same as that of the stress diagrams in general; it takes but a fraction of the time required for an analytical solution, especially when there are many joints or several loads at some of the joints. Once the method is mastered it also appears to require much less effort.

In order to avoid confusion it is advisable to draw the structure to a fairly large scale (1/6 or 1/10 size) and to make the lines representing the members rather heavy—considerably heavier than the lines representing the loads and those required for determining the applied resultant loads and for solving the joints. A larger scale also makes for greater accuracy. (Fig. 4 is drawn small and is not very accurate). One of the useful features of this method is the ease with which errors can be corrected. Should it be found that a resultant force at one of the joints is wrong, it is only necessary to find the correct force, draw a line from the end of the original resultant to that of the correct one and apply this last "equilibrant" force as a new load at the joint. The stresses resulting from this correcting force are then added vectorially to the original stresses. It is best to avoid crossing one line with another, especially crossing structural members. A line should be interrupted to skip those which it has to cross. It is important that the joints should be exact projections, one above the other, or else the end points of the loads as laid off in the various views will not align well. The dividers play an important part in the work, and should therefore be of good quality; preferably two pairs should be used, large and small. Triangles should be true.

Here are some of the errors which should be carefully avoided:

1. Starting out with the external loads laid off incorrectly.
2. Overlooking one of the applied loads or members, especially when these are in a different projection.
3. Using the opposite direction to the one indicated.
4. Marking the stress with the wrong kind of arrow.
5. Drawing stresses parallel to the wrong members.
6. Taking the whole stress instead of the required projection.

M-50

(*Continued from page 38*)

the valve end of the tappet. Tappets bear directly in the case for a length of 3½ in. and are kept from rotating by a dural plate with guide slot in which the flattened upper end of the tappet rides. Valve guides are of special bronze for the exhaust valves and cast iron for the intake valves. Two piece telescoping tube valve gear covers are secured to the case by a one-piece adapter plate which holds all four valve gear cover sleeves at once, sealing the telescoping joint by means of tension against a Duprene seal.

Carburetion is provided by a Stromberg updraft NA–S3A carburetor with altitude control, bolted directly to the crankcase. Intake pipes serving each cylinder bank are bolted to the cylinder head against a Steelbestos gasket, and are attached to the case by a flange with rubber seals.

Ignition is provided by a single Bendix Scintilla SF–4L magneto driven at crankshaft speed by means of a splined coupling from the camshaft drive gear bolted to the rear end of the crankshaft. Sparkplugs are Champion M–2 or BG 4B–2.

Lubrication under pressure is provided to the main crankshaft bearings, all connecting rod bearings, both camshaft bearings, and the accessory case. Oil is picked up by the gear pump from the sump through a tubular strainer extending the full length of the case. This strainer may be removed for cleaning from either end of the engine by detaching a single plug nut.

The accessory case at the rear of the engine is sealed with a Vellumoid gasket. The propeller end of the shaft is sealed by a removable seal to the crankshaft and a Vellumoid gasket between the front cover plate and the case. Thrust of the crankshaft is taken by a steel shoulder on the crankshaft which bears against a bronze thrust bearing.

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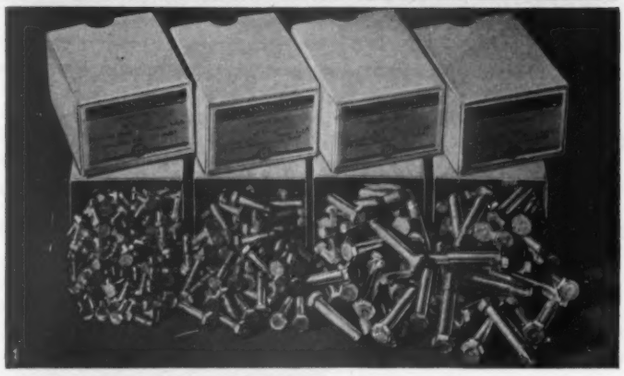

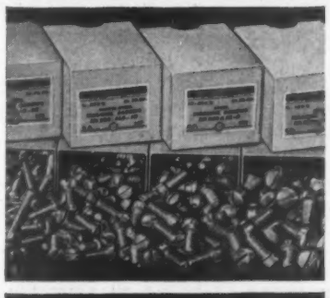

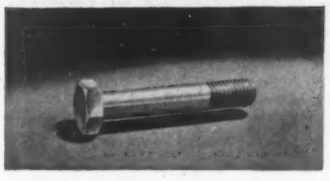

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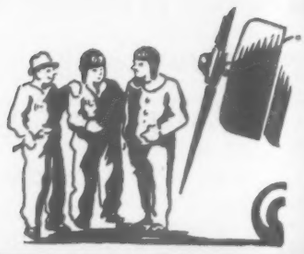

An exchange of ideas on the problems of the commercial aviation industry

QUESTION 27: What has been your experience in selling airplanes to prospects who carry substantial life insurance? Have you found the ratings put on private pilots productive of sales resistance? What methods have you used to overcome the difficulties resulting from this condition?

Expert Opinion

AS CHAIRMAN OF THE AVIATION COMMITTEE of the Actuarial Society of America, and in that capacity a member of the Bureau of Air Commerce Advisory Board, I was interested in the discussion of your Question 27 "Does Life Insurance Furnish Sales Resistance?" in your December number.

I have found in many instances that an unfavorable attitude of aviation men toward life insurance is due to misunderstanding. In general, a life insurance contract effected at a time when the applicant had no present, past, or interested connection with aviation other than as an occasional passenger is unrestricted as to subsequent flying. The proportion of policies which are restricted because of such connection is very small. This is pointed out by your correspondent, Mr. Alfred B. Bennett.

I have sometimes suspected that the insurance argument is used to stall off the salesman of airplanes or airplane travel and that the prospects in question would use some other excuse if this one did not work.

It is true that a prospective airplane purchaser who expects to increase his holdings of life insurance will have to pay a higher rate if he buys it after becoming a pilot. That is inevitable until air accidents become much less frequent in relation to the amount of flying, or until the time comes when flying one's plane is nearly as common as driving one's own car. That is, the existing situation is due to the fact that our chance of having to pay a claim within a given period of time is much greater in the case of the average man who is now a pilot than in the case of the average man who is not. It is true that some non-pilots will become pilots and we have to continue their insurance at the non-pilot rate, but they are the exceptions and probably will be for some time to come.

It would be easier for us if we did not have to give any more consideration to the fact that one man flies a great deal than to the fact that another man is fond of swimming, but with the facts as they are we can no more do that than we can ignore the fact that a man of fifty is more liable to die in the next year than a man of thirty.

Your correspondents mention two problems, policies which carry riders and the cost of unrestricted policies. The obvious remedy for the former is to buy full coverage insurance at the appropriate price from one of the numerous companies which sell it. However, a new pilot may find difficulty in obtaining full coverage insurance at any price until he has passed the over-confident stage that so many seem to go through after being certificated. The other problem, that of a fair price for full coverage insurance on pilots, is a difficult one as regards private pilots, since they differ so much both in ability and in amount of annual flying time (or so it seems to the writer). One of your correspondents speaks of a fair price as "a low reasonable figure." I am afraid that at the present time a reasonable figure and what many pilots would regard as a low figure are not quite the same thing.

The subject of insuring private pilots is one on which the last word has not been said and conceivably some of your readers, once they understand our side of the problem, can offer some practical suggestions.—J. E. HOSKINS, *The Travelers Insurance Company, Hartford, Conn.*

Next Month's Questions

QUESTION 28: What specific methods have you used to promote your business? What forms of advertising have you used and to whom has it been directed? Have you made use of contests, premiums, exhibitions and with what success? What original methods have you developed for this purpose?

QUESTION 29: What are your reactions to the new Civil Air Regulations, abstracted for the first time in the November issue of AVIATION? Are the requirements regarding licensed instructors, qualications for certificates of competency, medical examinations, etc., in the best interests of the flying service operators? Are there any C.A.R. provisions to which you object?

No Fun!

AS A PRIVATE FLYER, business man and the owner of a Ranger Fairchild, I am in favor of practically all of the new Civil Air Regulations, except that portion pertaining to my taking a friend, who is a private flyer, riding in my ship with dual controls installed.

Here in California, we have a good deal of high country to fly over as well as much flat country that requires the attention of a navigator as well as someone operating the controls on certain trips. Whenever we go fishing, hunting, or on a business trip, we cannot go together and alternate the flying unless one of us procures an instructor's rating.

In my short career of flying, about eight years, I have taken hundreds of people on their first flight. A good percentage have purchased planes, or now use the air lines or charter sightseeing planes, or are taking up flying themselves, or last, but not least are now "talking aviation in general" instead of being rabid against it. If that portion of the C. A. R. that I mentioned above is not rescinded, it will, in my estimation, work quite a hardship on the manufacturers of private ships. A large percentage of the reasons for owning a ship and the fun of running it is lost if the C. A. R. pertaining to what I mentioned above is not changed.—P. L. MCMULLEN, *President, Oakland Company, Oakland, Cal.*

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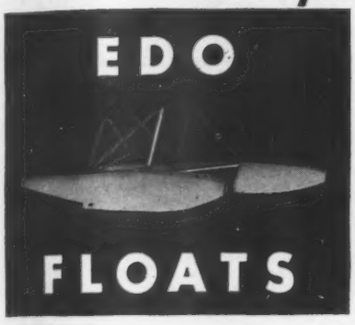

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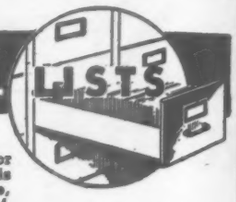

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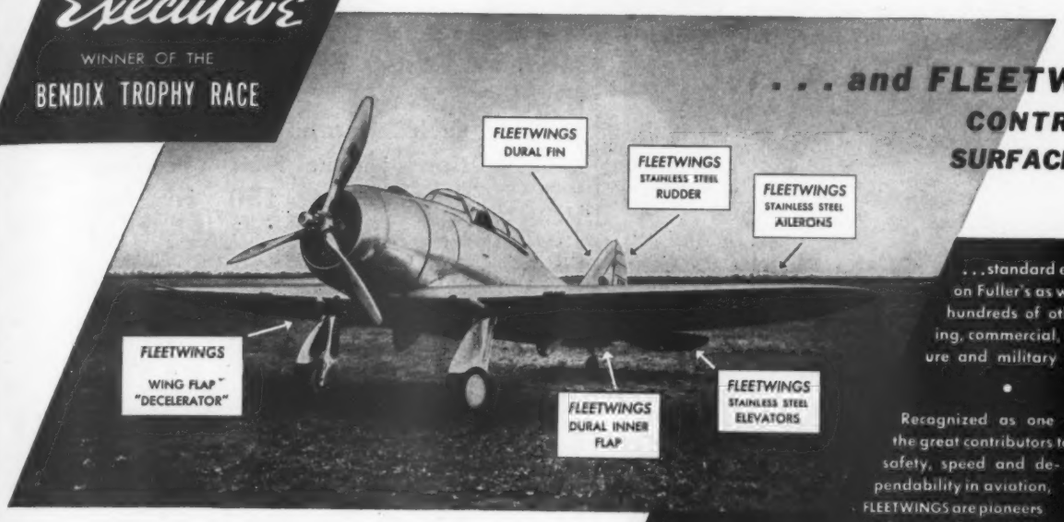

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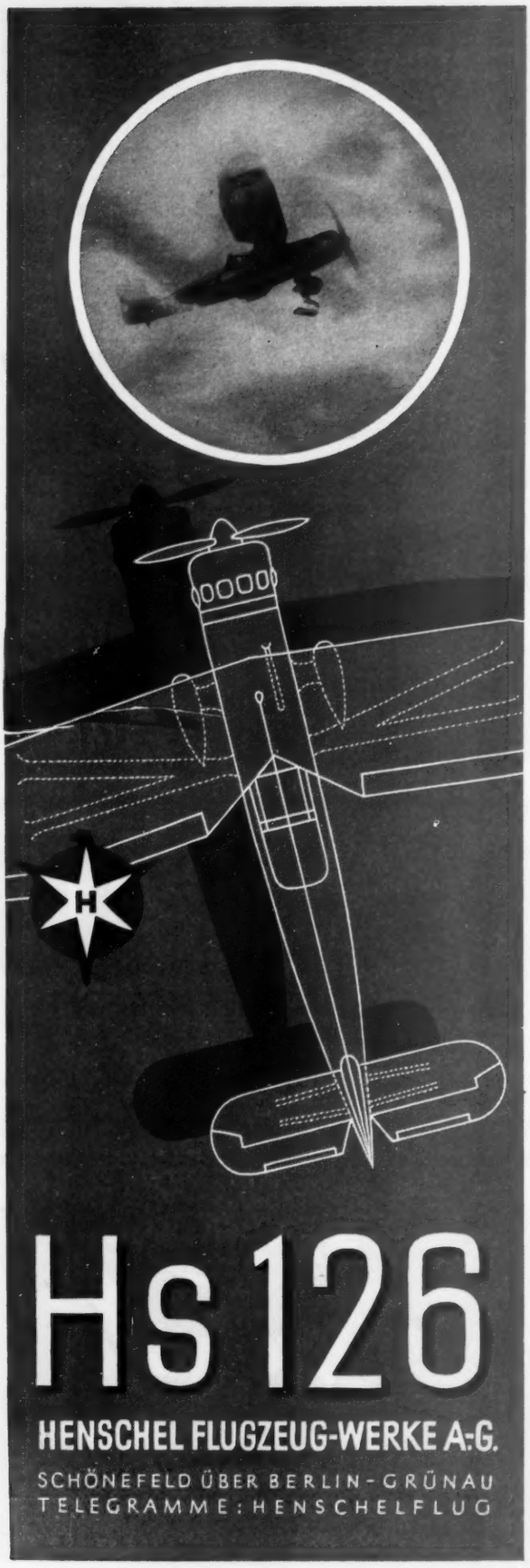

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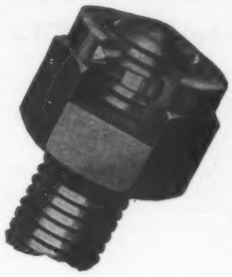
OVER LAND  AND OVER SEA

YOU FEEL SAFER WHEN YOU KNOW YOUR PLANE IS EQUIPPED WITH

UNSHAKO

"THE NUT THAT CAN'T SHAKE LOOSE"

They're unexcelled for use on wings, fuselage, floats, tail surfaces, engines, etc.

Fig. 1510 shown above is a cut away section showing the locking ring in place. "Unshako" self-locking nut is patented with other patents pending.

No matter how carefully a mechanic goes over a plane or how tight he gets every nut before the take-off . . . . once the ship's in flight, vibration goes to work, trying to loosen the very nuts that must stay tight if the maximum of safety and protection is to be assured.

There is one certain way to stop vibration's chances . . . . equip with "Unshako", the nut that can't shake loose. These unique self-locking nuts are one piece construction. A built-in locking ring holds the nut in place once it has been tightened and no amount of shaking can dislodge it. . . . only with the aid of a wrench can it be removed, but then it comes off easily. Because there are no separate washers or pins to fumble with, lose, or forget when installing 'Unshako" saves time and labor charges. . . . mighty important factors to consider when comparing purchase prices.

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$495 Down
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Deluxe equipment extra.

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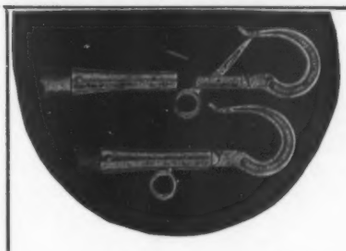
AMERICA'S FINEST LOW PRICED AIRPLANES



"GRABIT" BOAT HOOK — for all types of water craft—Seaplanes, Amphibians, and Flying Boats

NO MORE DUCKINGS!

There's no more danger of injury or sudden immersion while trying to make the plane fast when the "GRABIT" hook is used.

Here's the way this new patented device works: When ready to use, remove the cotter pin, hook the mooring or float ring and withdraw the handle, holding the line in the other hand, or attach same to a cleat or bitt. The tongue snaps out and the plane is made fast by the line from the eye.

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The British Air Ministry has approved its use.

RETAIL PRICE
$12.00

The THOMAS LAUGHLIN CO.
Manufacturers of Marine and Industrial Hardware since 1856
PORTLAND, MAINE

Planes, Engines and Parts For Sale—Products—Services

Continued on pages 79, 80, 81, 82

FOR SALE: Stinson SM8A, just relicensed for one year. Has extras, flares, fabric in good shape. Motor just rebuilt by airline. Has new type landing gear. Will sacrifice for $1,275 cash. Roland Maheux, Auburn, Maine. No. 1

1936 AERONCA—Licensed to June 1938, 180 hours total time. Privately owned. Ship and engine in excellent condition, always hangared. Must sell at once so priced exceptionally low $800 cash. William Thornbrough, Fowler, Indiana. No. 2

KR-34 CHALLENGER motor: $895. Starter, brakes, airwheels, all vermilion. Must be sold at once to settle estate. Will finance $450. Airways, Inc., Waterville Municipal Airport, Waterville, Maine. No. 3

CUB, E2. Licensed. Excellent, $745. Cub, J2 Demonstrator. Little time, like new in every respect, many extras. Trade and finance. Clarksburg Flying Service, Clarksburg, W. Va. No. 4

WACO 1936 Custom cabin. Lights, flares, bank and turn, climb, clock, radio, pants, steel prop, large tanks; 5-place; Insignia blue with cream trim. 225 Jacobs; 1 year old. 160 hours. Never scratched; priced to sell, cannot be told from new ship. Dixie Airways, Inc., Shushan Airport, New Orleans, La. No. 5

AERONCA PC 3. Delivered late 1936. Corrosion proofed, stainless cables, compass, extra 5 gallon tank 385 hours. Only 65 on water. Never damaged, clean condition recently overhauled. Red Bank Airport, Red Bank, N. J. No. 6

ARROW SPORT: Powered by Ford V-8; total time 20 hours. Curtiss Wright Sedan; Powered by J67E—Generator—Electric Starter—Full night flying equipment—Excellent airplanes for all types of aerial photography. The above airplanes can be financed. Safair, Inc. Hangar B, Roosevelt Field, Mineola, N. Y. No. 7

1935 AERONCA, damaged $350; J5-Stinson $650; Heath $77.50; Aeroncas $350 up; Aeronca motor $65; OX-ships $125 up. 100 other bargains. Send 25c for big Winter Directory. Used Aircraft Directory, Athens, Ohio. No. 8

ARROW V-8 Gull-Wing less than 20 hours, brakes, tailwheel, lights, starter, compass, modernized water pump, large crankcase. Licensed February 1939. Cost over $1850, prices for quick cash sale, no trades. Housatonic Air Service, 1738 Elm Street, Stratford, Conn. No. 9

FAIRCHILD "24" 1937 DeLuxe, new model. 165 Horsepower Ranger 6-410B engine. This ship used by service department of engine company. Had special care and in excellent condition. Engine just factory rebuilt. Airplane fully equipped, turn and bank, rate of climb, lear receiver, flaps and pants. Price $5,000. Ranger Engineering Corp., Farmingdale, N. Y. No. 10

LAIRD SPECIAL SPEEDWING, two-way radios, R.C.A. sensitive altimeter, many others. F. S. 409, Aviation, 330 West 42nd Street, New York City. No. 11

OX5 WACO 10. Sell best offer. 850 hours total 325 on motor. Good condition. New flotters propeller. 26 x 5 tires. Always hangared. Licensed to September 1937; tools, extra parts. Arthur L. Harris, Worton, Md. No. 12

FREE AEROPLANE with motor purchase. Easy terms, $12.50 down. 200 pounds useful load. Welded steel construction. Propellers—all types—98c up. Sensational values. Illustrated information and flying manual. 25c. Universal Aircraft, Fort Worth, Texas. No. 13

BELLANCA SKYROCKET, 450 h.p. Wasp SC1. Flown less than 100 hours since complete overhaul of ship and engine at their factories. 1,000 mile range. Complete instruments. Price reasonable. F.S. 413, Aviation. 330 W. 42nd St., N. Y. C. No. 14

ENGINES AND PARTS for sale Liberty 400 h.p.; Hispano E 180 h.p.; also quantities of Pratt & Whitney, Wright, Curtis and Packard engines. The Vimalert Company, Ltd., 841 Garfield Ave., Jersey City, N. J. No. 15

WASP "B" MOTOR. Less than 225 total hours. No time since overhaul. Three blades pusher type prop which needs straightening. Complete $350. Carl Taugh, Box 421, Marquette, Michigan. No. 16

CHALLENGER ROBIN, A-1 condition $750; Whittelsey Avian, just rebuilt and majored $800; Fairchild 22, A-1 condition $1250; Fairchild 21, majored and perfect shape $1150; Lambert Monocoupe, majored $2200. Fledg, Robin, and other parts. Aircraft Brokerage, Flushing Airport, Flushing, L. I. No. 17

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March, 1938

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STINSON TRIMOTOR U and T parts; Pilgrim parts; Hamilton Standard adjustable propellers and Magnetoes; Carburetors; Ignition switches; J5, Lycoming and Wasp B cylinders. General Airmotive Corporation, Municipal Airport, Cleveland, Ohio. No. 18

TAYLOR CUB: 1937 de luxe; licensed to June 1938. Like new; total time 40 hours; dual ignition, roller bearing wheels; blue and yellow; $1,100. Holmes Flying Service, Inc., Holmes Airport, Jackson Heights, N. Y. No. 19

1937 CUB: 2½ months old looks like new. Total time 90. Blue and Yellow, Roller bearing wheels, carburetor and cabin heater, spinner, always hangared. Price $1,100 Parkersburg Flying Service, Parkersburg Airpot, Parfkersburg, W. Va. No. 20

LOW WING AERONCA, Warner, demonstrator, 428 hours total, regular instruments, navigation lights, Exide battery, flap and RCA radio, including major overhaul. Perfect condition. Aircraft Service, Municipal Airport, Cleveland, Ohio. No. 21

WACO D.S.O. 180 Hisso, NC-629N. New covering. Tail wheels. Brakes. Steel propeller. Excellent condition. Sale or trade on "Waco F". Murray C. Taylor, 112 Sunset Place, Latonia, Ky. No. 22

CUSTOM WACO, 1934, Jacobs just modernized at cost of $750, hand rubbed, pants, lights, flares, turn and bank, climb, receiver, generator, starter, instrument hood, excellent condition, deliver anywhere, make offer. J. T. Moore, Jr., Box 893, Reading, Pa. No. 23

AERONCA, K, Compass, navigation lights, ball bank, 192 hours. Privately owned. Priced for quick sale. Red Bank Airport, Red Bank, N. J. No. 24

OX ROBIN, excellent condition, RCA radio, blind flying instruments, Hamilton steel propeller, other extras, licensed to November, 1938. FS 415, Aviation, 330 West 42nd Street, New York City. No. 25

AERONCA C-2 wings, aileron, fuselage, 700 x 4 airwheels also some E107 motor parts. R. E. Siegenthaler, 950 S. Linden Avenue, Alliance, Ohio. No. 26

WACO A 125 Warner, vermilion and silver, looks like new. Airspeed exhaust ring, airspeed starter, hand rubbed finish. Total time 152 hours. Sacrifice at only $1,500. Parkersburg Flying Service, Parkersburg Airport, Parkersburg, W. Va. No. 27

LOERING COMMUTER: Completely overhauled, new covering, refinished. Hull tight, perfect throughout. Trades considered. Aero-Ways, Inc., Cleveland Airport, Cleveland, Ohio. No. 28

CUB 1935—Motor just majored, entire ship refinished, new tires, equivalent to a new ship. $695.00. Skyways, Inc., Cleveland Municipal Airport, Cleveland, Ohio. No. 29

1937 CUB, perfect condition, spinner cap. Worster heater, tail wheel, winter enclosure. Licensed May 1938. Need cash. $950.00. John Barickman, 1307 Roslyn Avenue, S. W., Canton, Ohio. No. 30

STINSON S, 1931: 4 place cabin, Lycoming 215 h.p. Extras include retractable landing lights, mud guards, electric starter. Good condition. Price now is only $1,375.00. The H. C. Robbins Company, Cleveland Airport, Cleveland, Ohio. No. 31

EDO 3300 FLOATS in excellent condition. Overhauled Lycoming engine, Lycoming propeller blades, Lycoming oil pump, Pyle-National landing lights. Wm. Leithold, Municipal Airport, Minneapolis, Minn. No. 32

MODEL 2 FLEET, Navy specifications. New Kinner engine installed, total time 20 hours, total ship time 1700 hours. Brakes, air speed and compass installed. License expires August 15, 1938. $1585. Aircraft Service, Municipal Airport, Cleveland, Ohio. No. 33

WACO CUSTOM CABIN five place, built May 1936; Jacobs 285; 143 hours total time, RCA radio, turn and bank, rate of climb, flares, special paint, Kensington Gray and Fokker Red, ship and motor like new, given perfect care. Sacrifice at only $5,900. Parkersburg Flying Service, Parkersburg Airport, Parkersburg, W. Va. No. 34

WACO CABIN, 1937: 5 place S-7, Jacobs 225 h.p. Extras include flares, arm rests, landing lights, bank and turn, rate of climb, RCA receiver, cabin heater, electric gas gauge, prop spinner, compass light. Only 43 hours total time. Perfect condition throughout. Only $4,950. Write for details. The H. C. Robbins Company, Cleveland Airport, Cleveland, Ohio. No. 35

BEECHCRAFT C-17-B powered with Jacobs L-5 285 engine, magneto ignition; total gasoline capacity, 75 gallons; Curtiss Reed propeller. Special equipment: 2 Irvin 24' parachutes; completely bonded and shielded; R.C.A. AVT-7 transmitter; R.C.A. Radio compass; remote control hand-wound trailing antenna reel; Sperry directional gyro; Weston thermocouple; Ammeter; Pioneer rate of climb indicator. Total airplane time 275 hours; total engine time since overhaul 85 hours. Price $5,000.00. Esso Hangar, Newark Metropolitan Airport, Newark, N. J. No. 36

CURTISS JR.—Salmson powered, plane and engine completely overhauled, same as used by Mr. Hyde for coyote hunting, story in February issue of Western Flying. Meinke-Eldred Flying Service, Lost Nation Airport, Willoughby, Ohio. No. 37

Planes, Engines and Parts For Sale—Products—Services

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RYAN B-5: Repossessed, Wright J-6-9, plane equipped with steel propeller, starter, brakes, air wheels, landing and navigation lights, standard instruments plus compass and bank and turn, now licensed, both plane and motor in excellent condition, will finance. Also for quick cash sale, Velie 65 HP motor complete, excellent condition. Aircraft Finance Co., 521 M. & T. Bldg., Buffalo, N. Y. No. 38

LINCOLN P. T. Kinner K-5 for sale or trade for Cabin plane. Skyways, Inc., Cleveland Municipal Airport, Cleveland, Ohio. No. 39

FAIRCHILD KR-34. Wright J6-5 steel prop, semi-airwheels, brakes, dual controls. Total ship and motor 320 hours. Motor modernized and just overhauled. Licensed to December 1938. Perfect condition. $1100.00 cash. George M. Milliken, Jr., 303 Boxley Bldg., Roanoke, Va. No. 40

1935 DOUGLAS-DOLPHIN, Model 8-114,-powered with two SC Wasp 10:1 blowers having had 75 and 109 hours, respectively, since overhaul. Total airplane time 739 hours. Airplane recently painted and in good flying condition. Passenger capacity five, crew two. Special equipment; Sperry Directional Gyro, Artificial Horizon, Kollsman Sensitive Altimeter, Kollsman Aperiodic Compass, RCA Radio Receiver and Transmitter. Airplane at Esso Hangar, Newark Metropolitan Airport, Newark, New Jersey. For information contact Aviation Department, Standard Oil Development Company, 26 Broadway, New York City. No. 41

ATTENTION FOREIGN MARKETS. Cyclone parts at bargain prices, including reduction gear parts. Special price on one cyclone 1750E1 575 H.P. with little time. Engine Air Service, Inc., Garden City, N. Y. No. 42

USED SHIP CLEARING sale Cub demonstrator slightly used at reduced prices. Late model Cubs $795 up. Pitcairn PA7S Wright 250 $1,200. Pitcairn PA6, $795, cruises 115. Eaglet cheap. Many other good buys. All financeable. Bennett Air Service, Hightstown, N. J. No. 42 A

Products

Books

BLONDIN'S Aircraft Chart. Names, dates, records and 94 pictures $1.00. Blondin Chart Co. Box 34, Los Angeles, California. No. 43

PILOTS—Instructors—Examination Questions on New Civil Air Regulations now included in new "Aeronautical Training, just off the press—also Engines, Aircraft, Navigation and Meteorology—all with questions and answers only $2.00 postpaid. Quiz System, Box 608, San Diego, California. No. 44

Catalogues

TWO NEW CATALOGS now ready. One thin dime brings you either one. Two dimes brings you both. Specify whether you want Aviator's Personal Equipment Catalogue or Aeronautical Supply Catalogue or both. Karl Ort, 604 Poplar Street, York, Penna. No. 45

Floats

FLOATS for Cub or Taylorcraft. 62 hours. Perfect condition. New Taylorcraft at big discount. Associated Air Services, Palo Alto, California. No. 46

Hangars, Portable

INDIVIDUAL HANGARS—The answer to low cost storage $420 complete, shipped anywhere. Easily erected. Bennett Air Service, National Distributors, Hightstown, N. J. No. 47

Parachutes

SEVERAL GOOD used chutes from $40, up. Jos. Crane, Roosevelt Field, Mineola, N. Y. No. 48

Pontoons

PONTOONS FOR SALE. Edo Model 383. Hunter Company, Shrine Bldg., Memphis, Tenn. No. 49

Radios

AERONAUTICAL Radio Company, Roosevelt Field, Mineola, N. Y. Tel. Garden City, 6770. Aeronaut remote controlled antenna reels; Antenna drag socks; lead weights; ignition filters —R.C.A. Western Electric Lear. No. 50

AERONAUTICAL Radio Co., Roosevelt Field, Mineola, N. Y. Tel. Garden City 6770. Used receivers and transmitters. R.C.A., Western Electric, Lear. Airline surplus equipment. Radio shielded spark plugs. Write for information. No. 51

Services

Flying Instructions

HOW TO START a flying club. Send 10c for all the dope. Tells how you can learn to fly. Bennett Air Service, Highstown, N. J. No. 52

YOU CAN BECOME a graduate airplane mechanic in ten weeks at $1 per week! Free Catalog. Home Training. United-Air School, Box 528A, Elgin, Ill. No. 53

No. 54

THE BENNETT PLAN places new airplane in operation for you. Ideal for flying clubs or individual wishing to start flying business. Little or no capital necessary. Write Bennett Air Service, Box 247, Hightstown, N. J. No. 54

LEARN FLYING FOR fun. Become competent pilot during leisure time. Lesson each week, $2.50. Solo course, $50. New airplanes, expert instructors. Quaker City bus direct from New York or Philadelphia. Bennett Air Service, Airport, 4 miles south of Hightstown, New Jersey. Free booklet. No. 55

EASTERN AERONAUTICAL CORP.—24-hour hangar service. Mobilgas and Mobiloil; Airplanes for charter and sightseeing. Also Stinson Lycoming Sales and Service. Airport, Newark, N. J. No. 56

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Positions Vacant

WELL INFORMED CONTRIBUTOR wanted for leading technical magaine. P. 408, Aviation, 330 West 42 Street, N. Y. C.

PILOT—Fixed base manager: Seaplane and instruction rating. Near New York. P-416 Aviation, 330 West 42nd Street, New York City.

Positions Wanted

TEN YEARS executive business experience plus 1000 hours flying experience offered to some important individual or firm with important things to do, accomplished by this combination. Transport license, excellent record, prominent references. Employed at present—sales promotion. Age, 32, single. Want new connection for coming spring. Write Box PW 414 Aviation, 330 West 42 Street, New York City.

LICENSED A & E Mechanic, 20 desires airport work in East. Good references. PW 419 Aviation, 330 West 42nd Street, New York City.

ENGINEER, 26, experienced in all-metal design and analysis of small airplanes desires position with manufacturer. PW 418 Aviation, 330 West 42 Street, New York City.

Wanted

K-3D or F-4 Fairchild Aerial Camera of 8¼ inch focal length or K-5 Folmer of twelve or twenty inch focal length. State lowest cash price. FS-420, Aviation, 330 West 42nd St., New York City.

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AVIATION jobs for inexperienced workers. Send stamp for complete details. Desk D, Airployment, Box 553, West Los Angeles, Cal.

Business Opportunity

WANTED: Partner to help develop simplified, all-metal low-wing for popular priced field. Designed and stressed by experienced engineers. Investment required. B.O. 417-Aviation, 330 West 42 Street, New York City.

U. S. Government

WAR DEPARTMENT, Materiel Division, Air Corps, Wright Field, Dayton, Ohio, Office of the Contracting Officer.—The War Department invites the submission in competition of sealed bids covering airplanes under conditions set forth more particularly in the following advertisements: Circular Proposal No. 38-370 dated November 24, 1937, Corps and Army Observation Type described in U. S. Army Specification No. 98-409 dated October 20, 1937, bids to be submitted to the Contracting Officer not later than 1:00 P. M., Eastern Standard Time September 26, 1938, Circular Proposal No. 38-390 dated November 24, 1937, Single Place Pursuit (Single Engine) Type described in U. S. Army Specification No. 98-610 dated November 2, 1937, bids to be submitted to the Contracting Officer not later than 1:00 P. M., Eastern Standard Time September 27, 1938 and Circular Proposal No. 38-395 dated November 26, 1937, Bombardment (Two-Engine) Type described in U. S. Army Specification No. 98-207 dated November 9, 1937, bids to be submitted to the Contracting Officer not later than 1:00 P. M., Eastern Standard Time February 2, 1939. Full particulars with respect to said advertisements may be obtained upon application to the Contracting Officer, Wright Field, Dayton, Ohio, E. T. Kennedy, Major, Air Corps, Contracting Officer.

WAR DEPARTMENT, Material Division, Air Corps, Wright Field, Dayton, Ohio, Office of the Contracting Officer.—The War Department invites the submission in competition of sealed bids covering airplanes under conditions set forth more particularly in the following advertisement: Circular Proposal No. 38-385, dated January 18, 1938, Airplanes, Attack-Bomber (Two Engine), described in U. S. Army Specification No. 98-102 dated December 16, 1937; bids to be submitted to the Contracting Officer not later than 1:00 P. M., Eastern Standard Time March 17, 1939. Full particulars with respect to said advertisement may be obtained upon application to the Contracting Officer, Wright Field, Dayton, Ohio. E. T. Kennedy, Major, Air Corps, Contracting Officer.

1937 Rearwin Sportster Demonstrator, Ball Bearing Controls, Speed Ring, Brakes, Tail Wheel, $2250.00

1936 Rearwin Sportster, Brakes, Tail Wheel, Carburetor Heater and Other Extras, $1500.00

AIRPLANE OVERHAUL, ENGINE OVERHAUL

GENERAL AIR SERVICE

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1937 Porterfield, Zephyr Model.....$1000
1937 Porterfield, LeBlond Model.....$1600
1937 Porterfield, Warner Model.....$2200
All Three are Demonstrators with very little time.
1936 Waco Custom Cabin, 285 Jacobs, just majored, 2 way radio, complete set of instruments.

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Will accept trade on any of the above Airplanes

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Small tools, high speed and carbon drills, cutters, chucks, vises, etc.

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Stinson SR-6—2-way Radio
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Consolidated Air Service

Ford Airport Lansing, Ill.

Phone: Lansing 195

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Complete Sales and Service

Guaranteed overhaul and repairs.

New and reconditioned Gyros, Horizons, Turn Indicators, Sensitive Altimeters, Rate of Climb, Compasses, etc. Quotations on request.

AIRCRAFT INSTRUMENT SERVICE

CITY AIRPORT, DETROIT, MICH.

Planes, Engines and Parts For Sale—Products—Services

Continued from pages 78 and 79

9 OUTSTANDING BUYS

Sharp reductions in price to make room for twin-engined equipment this spring

NC 15812 1936 **BEECHCRAFT**, 285 Jacobs engine. Light Blue, black & red striping, 74 gal. tanks, Turn & Bank, Rate of Climb, Thermo-couple, RCA Receiver, Landing Lights, Flares. Total Time 504 hours, only 4 hours since Major Overhaul on engine. Excellent condition, beautiful finish. Ask any flyer within a thousand miles—our ships are seen and known everywhere in the East. **$5,500.**

NC 809-W SIKORSKY S-39, 400 HP Pratt & Whitney. Note that this is not a standard S-39, but one of the only two high-power jobs. This was the well-known Jacob Ruppert ship with a $4,000.00 special motor nacelle and streamlining design, giving 115 mph cruising. Gray hull, silver wings, RCA Radio to each seat, Rate of Climb, Turn & Bank. Extra tanks, unusual interior. Total Time since ship overhaul 320 hours, 135 hours since engine major overhaul. **$11,000.**

NC 15845 1936 **BEECHCRAFT**, 285 Jacobs engine. Dark Blue with Silver striping, 74 gal. tanks, Turn & Bank, Rate of Climb, RCA Receiver, Landing Lights, Flares. Total Time 295 hours. Engine now being majored by the factory. Condition and finish perfect—just as we keep all our ships. **$6,200.**

NC 16439 1936 **BEECHCRAFT**, 285 Jacobs engine. Dark Blue, Chrome Yellow striping, 74 gal. tanks, Turn & Bank, Rate of Climb, TWO-WAY RADIO (2 RECEIVERS, ONE TRANSMITTER), Landing Lights, Flares. Total Time 324 hours. Engine just completed our Major Overhaul. Standard O. J. Whitney condition and finish. **$6,500.**

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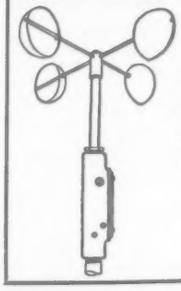

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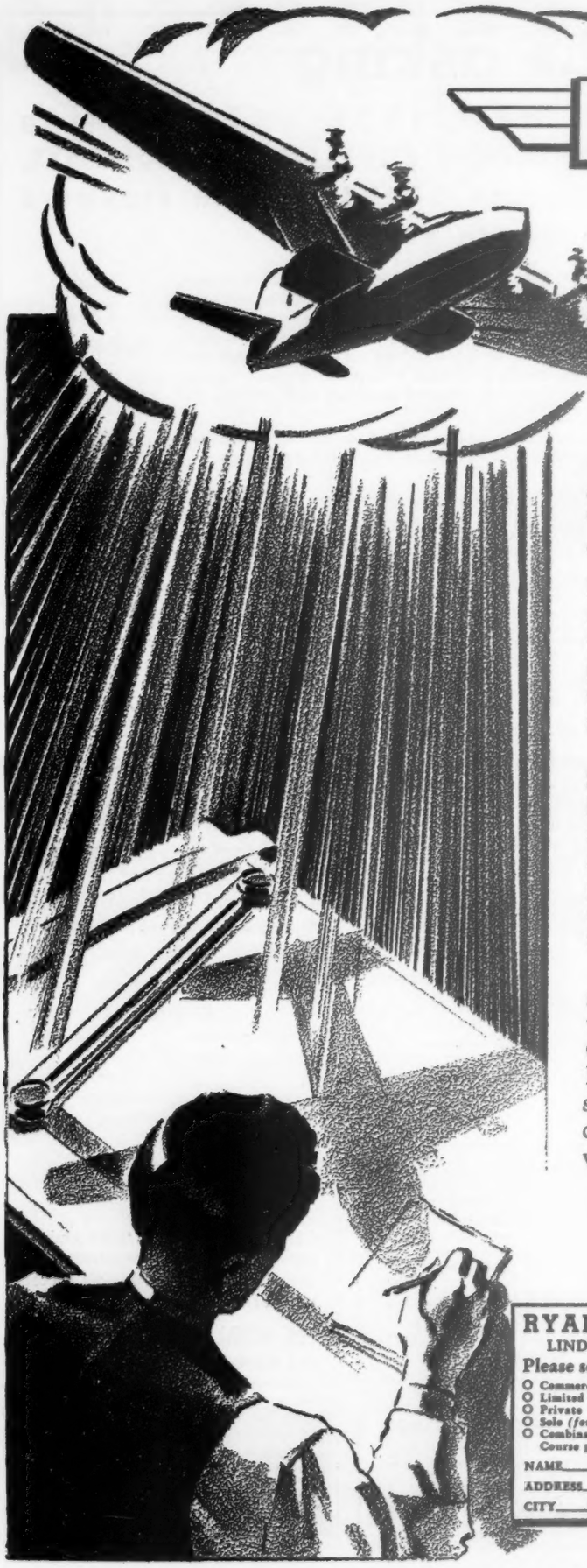

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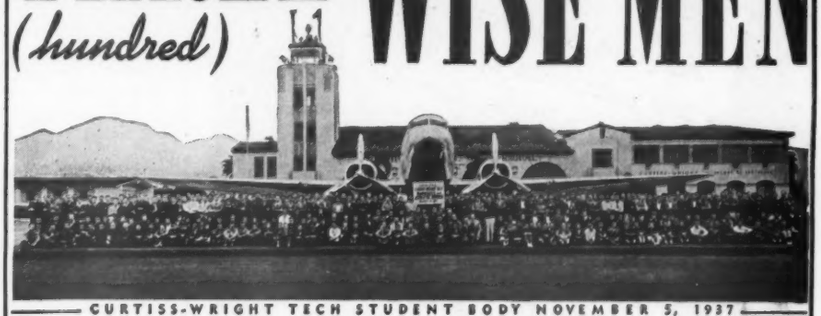

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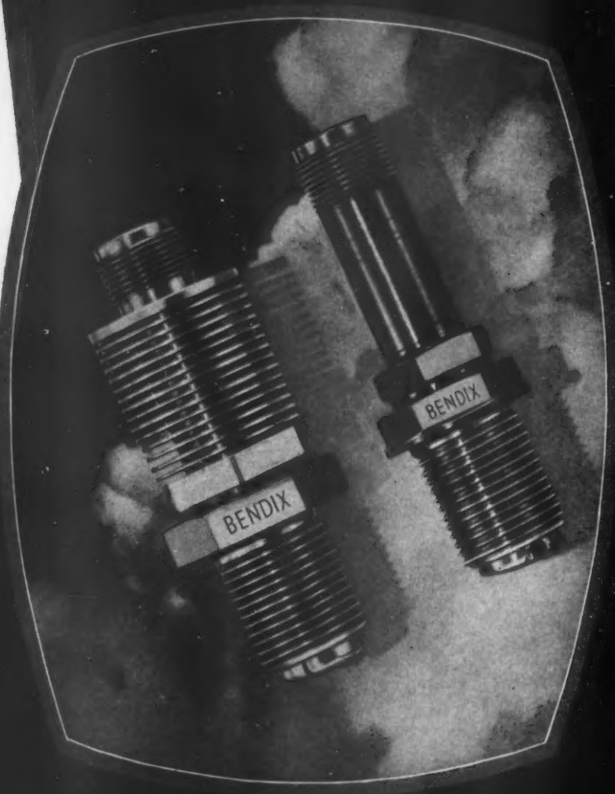

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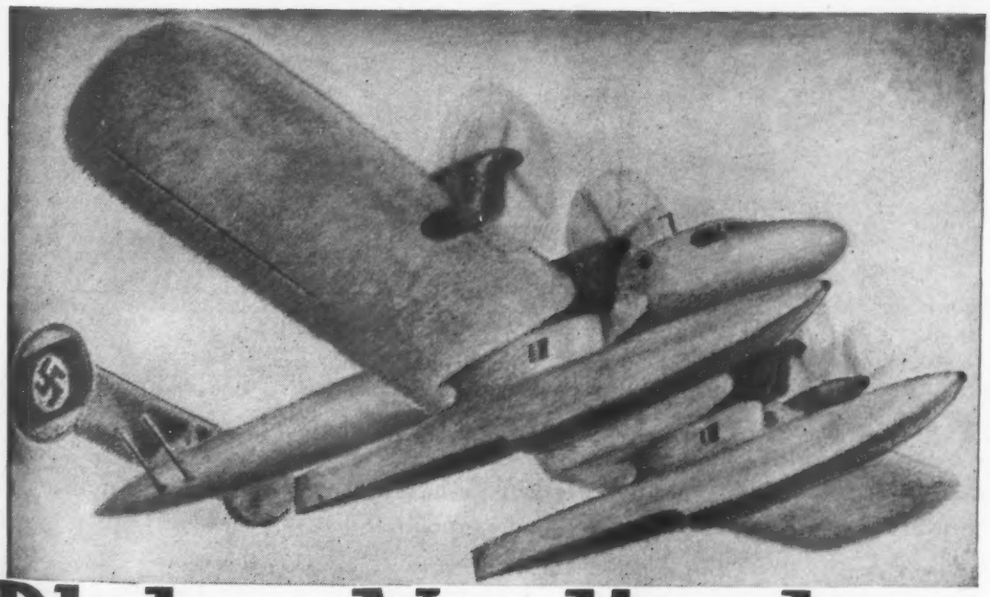

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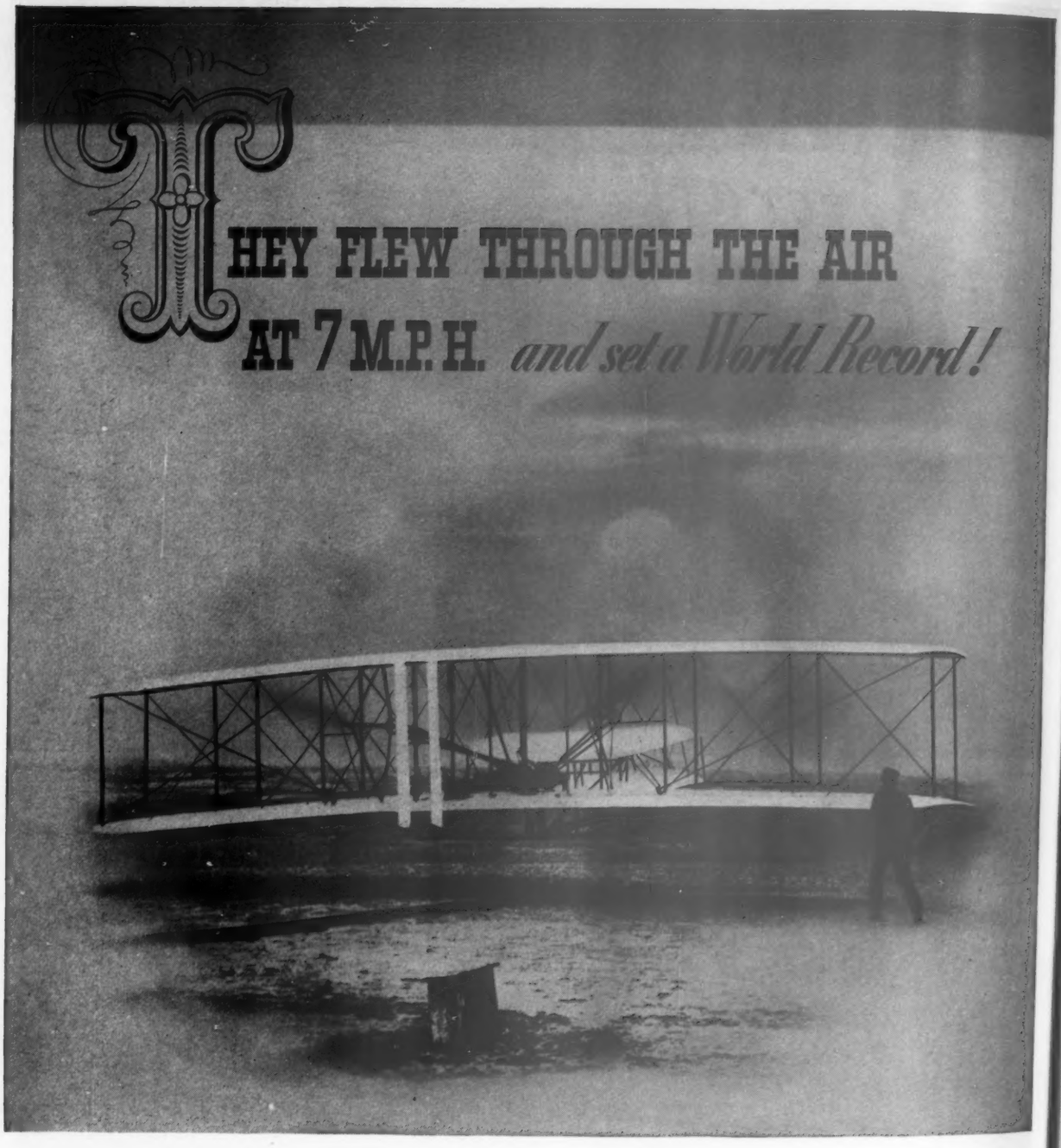

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